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IMPERIAL INSTITUTE OF ENTOMOLOGY.

REVIEW
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SERIES A.

VOL. 31. 1943.

KERR jr. (T. W.). **Control of White Grubs in Strawberries.**—*Bull. Cornell agric. Exp. Sta.* no. 770, 40 pp., 2 pls., 13 figs., 7 refs. Ithaca, N.Y., 1941.

The bulk of this bulletin comprises an account of investigations during 1938–40 of the control of larvae of *Lachnosterna* (*Phyllophaga*) spp. in strawberry plantings in New York State by scattering mixtures of sand and arsenicals in the holes in which the plants are set, some of the results of which have already been noticed [*R.A.E.*, A **27** 425; **29** 258; **30** 188]. *L.* (*P.*) *rugosa*, Melsh., *L.* (*P.*) *anxia*, Lec., and *L.* (*P.*) *fusca*, Froel., are the chief species concerned, but their relative importance varies locally [**29** 643]. Larvae hatched in 3–4 weeks from eggs deposited in June and July 1937; the eggs were generally laid in soil under grass, small grains, strawberry, weeds, etc., but bare soil also attracted the ovipositing females, whereas soil under leguminous crops did not do so. The larvae fed on vegetable matter in the soil until late September or early October and on roots during the spring and summer of 1938, when they were most injurious, and from spring until June 1939; the winters were passed deeper in the soil. Pupation takes place in an earthen cell at a depth of 6–8 ins. The pupal period lasts only a few weeks, but the adults do not emerge from the soil until the following spring; they are generally present from the beginning of May until mid-July. In western New York, the adults attack and may defoliate oak, hickory, poplar, elm, willow, ash and walnut, and in one area certain varieties of raspberry are preferred food-plants of the three important species and may suffer considerable injury; the raspberry plantations also serve as breeding grounds, and crops following the raspberries may be severely damaged.

Second-year larvae are abundant throughout the strawberry-growing areas of New York State in every third year, when they destroy about 40 per cent. of the newly-set plants; in the other two years, losses range from 8 to 12 per cent. As a result of experiments in 1938 and 1939, applications of a mixture of lead arsenate and sand (1 : 20) at planting time [**29** 259] was recommended, but since the effect of this treatment on yield has not been determined, although provisional data on the variety Premier indicate that it caused no significant reduction, this mixture should be used only when second-year larvae are most abundant. Experiments in 1940 indicated that the production of runners is reduced in treated plants; the rate of production after the normal period of maximum production for each variety was over was greater in treated than in untreated plants, but did not compensate for the loss due to retarded growth earlier in the season.

Hodson (A. C.). **An ecological Study of the Forest Tent Caterpillar,** *Malacosoma disstria* **Hbn., in Northern Minnesota.**—*Tech. Bull. Minn. agric. Exp. Sta.* no. 148, 55 pp., 6 figs., 20 refs. [St. Paul] Minn., 1941.

A detailed account is given of observations made during an outbreak of *Malacosoma disstria*, Hb., that occurred in deciduous forests in Minnesota from 1933 to 1938. The course of the outbreak is described with notes on previous ones, and the areas in which complete defoliation occurred are shown for each year on a map.

The larvae hatch in May, when the leaves of poplar begin to unfold. There are five larval instars in the field, but a sixth sometimes occurred in female larvae reared in the laboratory. Complete defoliation generally begins about 3 weeks after hatching, and the first cocoons are formed 2–3 weeks later. They were spun in rolled leaves, often of *Acer rubrum*, which was not attacked by the larvae. The pre-pupal and pupal stages lasted 2 and 8–12 days, respectively, and adults survived for about 5 days and were active in the field for about 2 weeks. Embryonic development is completed in the year in which the eggs are deposited, but hatching does not occur until the following spring. Larvae fed little at temperatures below 60°F.

Measurements of frass pellets indicated that the stage of development of the larvae can easily be determined from frass collections. The principal tree attacked was aspen (*Populus tremuloides*); other food-plants, in the usual order of preference, were *Acer saccharum*, *Tilia americana*, oaks (*Quercus borealis* and *Q. macrocarpa*), birch (*Betula papyrifera*) and elm (*Ulmus americana*). In some areas, garden crops and larch (*Larix laricina*) were attacked, and in 1936 strawberry, cabbage, peas, beet and potato were defoliated. Eggs were not laid on *Q. macrocarpa* or *B. papyrifera*; the buds of the former do not open until after the eggs have hatched, and larvae in the first two instars cannot survive on the young sticky leaves of the latter, but both trees are defoliated by the older larvae. It was found that larvae deprived of food during the last instar were unable to pupate, but larvae that fed for less than half the normal time could complete their development. Females developing from such larvae contained an average of 97 eggs, as compared with 174 in the controls.

Various methods of measuring populations by estimating the numbers of cocoons, larvae and eggs present are described, and the results of population surveys made during 1936–38 are given. The most valuable data were obtained from samples of egg-bands, which could be used as a measure of the total productivity in any area. A method of predicting the probable amount of defoliation of aspen to be expected in the following year is described and discussed. It is based upon the larval population, estimated from an egg survey, the feeding capacity of the larvae, calculated from experiments at 8½ leaves each, and the number of leaves per tree, estimated from the diameter of the trunk.

Natural control was exercised by a combination of factors, such as high summer temperatures, which injured the eggs or interfered with oviposition, and spring frosts occurring when the larvae were no longer resistant to cold. The parasites observed included *Sarcophaga aldrichi*, Parker [*cf. R.A.E.*, A **27** 646], which was much the most important, *Pimpla* (*Itoplectis*) *conquisitor*, Say, and *Zenillia protuberans*, Aldr. & Webber. About 20 per cent. of the cocoons in one area were destroyed in 1937 by crows. The larvae were preyed upon by *Podisus placidus*, Uhl., *Calosoma calidum*, F., and *C. frigidum*, Kby., and in some districts were attacked by a wilt disease, which, however, was not of great importance. Mites were often observed under the egg-bands, but no evidence that they attacked either eggs or larvae was obtained.

Outbreaks occur simultaneously throughout the United States and Canada at intervals of approximately 7–11 years [*cf.* **29** 395], but the causes of these fluctuations are not known. The way in which populations are built up from small numbers is discussed.

Smith (E. H.). **The Status of Peach Tree Borer Control in New York State.**—*Proc. N. Y. St. hort. Soc.* **87** pp. 170–172. Le Roy, N.Y., 1942.

Treatments for control of the peach-tree borer [*Aegeria exitiosa*, Say] are better applied in autumn, when the larvae are still small and easy to kill, than in spring when they are more resistant and will have caused appreciable damage. Either paradichlorobenzene or an emulsion of ethylene dichloride can be used, but the recommended time for applying the former in New York occurs in the middle of the fruit harvest, and, furthermore, the mounds formed round the base of the trees should be removed one month later. Ethylene dichloride is effective at lower temperatures [*cf. R.A.E.*, A **29** 160] and can therefore be applied later in the autumn ; the mounds can be left indefinitely. Investigations on injury to peach trees stated to have been caused by treatment with ethylene dichloride showed that in most cases the damage was initiated by " winter injury," while in other instances it was due to incorrect mixing or application. A proprietary emulsion should be mixed by passing it through a pump and back into the tank for several minutes. A home-mixed emulsion can be prepared by the method employed for emulsifying oil sprays ; a little water should be put into the tank with the engine and pump running, and the soap added ; the ethylene dichloride should then be slowly poured in, the remaining quantity of water added, and the material run through several times with the spray gun directed into the tank. A carefully measured amount of material should be applied to the soil round the base of the tree, and all wind cracks should be filled with loose soil. The emulsion should be applied when the soil is not excessively wet, otherwise it will not be readily absorbed [*cf.* **30** 529]. It is considered that the treatment is reasonably safe under New York conditions if these precautions are observed.

Dean (R. W.). **Early Season vs. Summer Control Measures for European Red Mite.**—*Proc. N. Y. St. hort. Soc.* **87** pp. 202–206. Le Roy, N.Y., 1942.

Experience with early-season oil sprays against the European red mite [*Paratetranychus pilosus*, C. & F.] on apple in New York has shown that the most effective is 3 per cent. petroleum oil in Bordeaux mixture (2–4–100), applied at the delayed dormant or the green-tip stage. These treatments will usually give protection throughout the season if other factors are favourable, but do not give complete kill of the overwintering eggs, of which 1–5 per cent. escape contact with the oil, and must sometimes, therefore, be supplemented by treatments later in the season. Attempts to control the mite with sprays at the pink bud stage have, however, failed, and none of the materials available for summer sprays is entirely satisfactory. The most effective have been tank-mixed or proprietary summer-oil emulsions made up to contain 1 per cent. actual oil of 60 secs. viscosity Saybolt, and a spray of 4 lb. ground derris root (5 per cent. rotenone) per 100 U.S. gals. water with a spreader ; the derris should not be used with highly alkaline materials such as lime or lime-sulphur. Rotenone does not affect the eggs, so that two applications of derris ten days apart are required for control equivalent to that afforded by one application of summer oil. Rotenone extracts have proved inferior to the ground root.

Dean (R. W.). **Emergence, Migration and Control of the Apple Maggot Fly.**—*Proc. N. Y. St. hort. Soc.* **87** pp. 291–295. Le Roy, N.Y., 1942.

As the apple maggot [*Rhagoletis pomonella*, L.] can be controlled only by measures against the adults, a knowledge of their habits is of importance. In New York, they are emerging from June to late August or September, and about 1 per cent. of the overwintering pupae give rise to adults in the second year after pupation [*cf. R.A.E.*, A **23** 373], so that no treatment can completely eliminate an infestation in one season. The pre-oviposition period lasts 7–10 days [*cf.* **24** 37], during which time the flies feed on nutritive substances on the surface of the fruits and foliage of the apple trees and other plants in and outside the orchard. They probably live about 40 days. In experiments, the average total number of eggs laid by a female was 164, with a maximum of 330.

For control, it is recommended that a spray of lead or calcium arsenate should be applied about 10 days after the first flies appear, and again a day or two after the emergence curve reaches its peak; a third application may be necessary in case of heavy emergence. Control is complicated by migration of flies into an orchard from outside, and catches in bait traps [*cf.* **29** 563] indicated that the numbers that do so are much greater than was suspected. Sprays do not control these migrating flies, which shows that they do not feed in the orchard to an appreciable extent before oviposition. Spraying or dusting the edges of adjoining woods or bushes is not sufficient, since the flies are known to move for more than 130 yards within the orchard itself, can probably do so through any stand of trees or bushes and can migrate for up to 700 yds. over open ground in search of host fruits. Since it is often impossible to remove or spray all trees and bushes within 250–300 yds. of the orchard, a thorough three-spray control programme should be carried out for several successive years, the adjoining hedgerows and trees being treated as well. All fallen apples should be destroyed at frequent intervals.

Essig (E. O.). **Red Scale out-of-doors in Berkeley, California.**—*Pan-Pacif. Ent.* **18** no. 2 p. 82. San Francisco, Calif., 1942.

The author records a heavy infestation of *Aonidiella aurantii*, Mask., on a small lemon tree growing in a garden at Berkeley, California, where it does not normally survive long in the open. No scales were observed on the tree when it was brought from Pasadena in 1937 ; infestation was first noticed in 1941 and had increased so considerably by 1942 that it threatened to kill the tree. There was no period of extreme frost during the preceding five years, but several frosts occurred that were severe enough to cause slight injury to the growing tips of *Citrus* trees.

Black (L. M.). **Specific Transmission of Varieties of Potato Yellow-dwarf Virus by related Insects.**—*Amer. Potato J.* **19** no. 8 pp. 231–233. 1941. (Abstr. in *Exp. Sta. Rec.* **86** no. 5 p. 644. Washington, D.C., 1942.)

The New York and New Jersey forms of yellow-dwarf virus of potato, shown by cross-protection tests to be varieties of the same species (*Marmor vastans* of Holmes), were found to be transmitted specifically by *Aceratagallia sanguinolenta*, Prov., and *Agallia constricta*, Van D., respectively, and the New Jersey virus is therefore named *M. vastans agalliae*, var. n. The specific relationship between the viruses and their allied vectors is compared with such highly specialised parasites as the rusts, and the evolutionary possibilities are discussed.

Barber (H. S.). **Raspberry Fruitworms and related Species.**—*Misc. Publ. U.S. Dep. Agric.* no. 468, 32 pp., 9 pp. refs. Washington, D.C., 1942.

The author discusses the great confusion that exists as to the classification and nomenclature of the beetles that have been referred to the genus *Byturus* and include species that attack raspberries in various countries. The correct name and the scope of the family to which they belong is uncertain, the generic name, *Byturus*, is incorrectly applied, though it is not at present desirable to change it, and the species of importance, both in Europe and the United States, have been misidentified. In this revision, the author erects two new genera (*Byturodes* for *grahami*, sp. n., from China, and *Byturellus* for *Byturus grisescens*, Jayne, and *grisescens dubius*, subsp. n., both from California and

Oregon), and distinguishes eight species of *Byturus* (from the United States, Europe or Asia) of which three are new. He also comments on a number of species of *Byturus* known to him only from their published descriptions (for one of which he proposes a new name) and on species that belong to other families but have been customarily catalogued in the synonymy of Byturids. The paper concludes with a chronological review of the literature and an alphabetical list of the numerous genera and species discussed, showing synonymy or systematic position.

The species recorded from the United States include *Byturus rubi*, sp. n. (eastern raspberry fruitworm), represented by specimens from New York, Wisconsin, Maine, Michigan and Massachusetts, and by others, not certainly conspecific, from these and other States and from Manitoba, Ontario and Quebec ; and *B. bakeri*, sp. n. (northwestern raspberry fruitworm) from Washington State and doubtfully from British Columbia. Both of these species have been confused with *B. unicolor*, Say, which appears to be widely distributed in the eastern United States but is not yet known to attack raspberry. There are further records that suggest the occurrence of raspberry fruitworms in western Montana, eastern Idaho and western Wyoming, but specimens are not available for identification. Infestation of raspberries by *B. rubi* is recorded definitely in New York and probably in Wisconsin and Maine.

Early names considered in discussing the European species include *Silpha aestiva*, L. (1758), *Dermestes fumatus*, F. (1775), *D. tomentosus*, DeG. (1774), and *D. tomentosus*, F. (1775). All these names have been used for one or other of three species of *Byturus*, but the author considers that *aestiva* belongs to the Nitidulid genus *Spiraea* ; that *fumatus*, F., is a confusion of two species but it included, and must be considered to be, *Typhaea* (*D.*) *stercorea*, L. (*D. fumatus*, L. 1767) : and that *tomentosus*, F., cannot be definitely identified. He concludes that *Byturus* (*Horticola*) *urbanus*, Lind. (*D. fumatus*, F., of early authors) is the correct name for the serious raspberry pest that has for more than a century been misidentified as *B. tomentosus*, F., and that the other two species are *B. tomentosus*, DeG., and *B. ochraceus*, Scriba (*aestivus*, L., auct., *fumatus*, F., of most authors).

WHITTINGTON (F. B.), CORY (E. N.) & LANGFORD (G. S.). **The Influence of Host Plants on the local Distribution of Japanese Beetles and on the Effectiveness of Traps.**—*J. econ. Ent.* **35** no. 2 pp. 163–164, 1 ref. Menasha, Wis., 1942.

Experiments carried out in Maryland with traps of identical pattern, containing the standard bait of geraniol and eugenol (10 : 1) and hung at a constant height in open, sunny positions, confirmed earlier conclusions that adults of the Japanese beetle [*Popillia japonica*, Newm.] tend to congregate in areas in which favoured food-plants occur. A row of five traps 10 ft. from the border of a rose garden caught 10,363 beetles between 9th July and 22nd August, as compared with 3,444–4,158 caught in similar rows of traps 160–610 ft. from the roses. In a series of tests carried out in six places, the numbers of beetles taken in traps 10 ft. from roses and grape-vines averaged 947 and 964, respectively, in 35 days, whereas traps 100 ft. away caught averages of 304 and 203, respectively. It is therefore concluded that local congregations of beetles are due primarily to the presence of preferred food-plants and not of traps.

LANGFORD (G. S.), VINCENT (R. H.) & CORY (E. N.). **The adult Japanese Beetle as Host and Disseminator of Type A Milky Disease.**—*J. econ. Ent.* **35** no. 2 pp. 165–169, 8 refs. Menasha, Wis., 1942.

Investigations carried out in Maryland in connection with the utilisation of type A milky disease of the larvae of the Japanese beetle [*Popillia japonica*, Newm.] showed that the adult is a host of *Bacillus popilliae*, the causal agent of the disease, since an adult from a larva that developed in soil containing the bacterium and others reared from larvae inoculated during the third instar were found to be infected, and adults that were inoculated with spores from larvae and larvae inoculated with spores from adults developed the disease. Since the disease was also found in field-collected adults, and larvae kept in soil mixed with spores from infected adults became infected, it is concluded that the adult is a factor in the natural dispersion of the bacterium. The fact that no evidence of disease has been found in recently infested areas, where the larval population is low, and that it appears as the larval population approaches a peak and increases rapidly when the peak is reached is probably due to the migration of infected adults from an area of high disease incidence. Of beetles inoculated with spores of the bacterium 35, 58 and 78 per cent. were dead in 15, 20 and 25 days as compared with 11, 14 and 17 per cent. of controls inoculated with distilled water. As the inoculated beetles readily developed the disease and remained active and vigorous until it was well advanced, collecting, inoculating and liberating adults may provide an economical way of supplementing the present method of artificially disseminating it, particularly at times when suitable larvae are not available for spore production. The adults might also be used for the production of spore dust.

FELT (E. P.) & BROMLEY (S. W.). **The increasing Importance of Coleopterous Borers in Shade Trees.**—*J. econ. Ent.* **35** no. 2 pp. 169–171. Menasha, Wis., 1942.

As a result of injury caused by the intense cold of the winter of 1933–34, the hurricane of September 1938, a sleet storm in March 1940, wind scorch in the late winter and early spring of 1941, and the droughts experienced in recent years, many shade trees in the north-eastern United States are so weakened that they are more than usually liable to attack by Coleopterous borers.

In 1940, *Hylastes* (*Hylurgopinus*) *rufipes*, Eichh., which usually attacks dying wood, was killing large, apparently healthy, American elms [*Ulmus americana*] in New Hampshire; the source of the infestation was piles of elm wood collected and left after the hurricane, from which large numbers of beetles emerged. In 1941, branches of elms in a number of localities in south-western Connecticut died as a result of heavy infestation by *Scolytus multistriatus*, Marsh.; in each case there were seams in the bark and wood of the apparently sound trees. *Hylobius radicis*, Buchanan, has become an important pest of Scots, Austrian and red pines [*Pinus sylvestris*, *P. nigra* var. *austriaca* and *P. resinosa*] in the same area during the past few years [*cf. R.A.E.*, A **30** 184]. The weevil invades the inner bark, cambium and outer sapwood just below ground level and ultimately girdles and kills the tree. Destructive attacks have usually been limited to trees less than 50 years old. Attempts to control the larvae by injecting carbon bisulphide into the tunnels or applying paradichlorobenzene or turpentine round the bases of the trees were unsuccessful; the best results were given by applying an emulsion of dichlorethyl ether. Digging the larvae out and feeding the trees with a balanced food to revitalise them gave fair results in some cases, but in heavy infestations the mechanical injury to the bark was too severe; spraying the base of the tree with lime-sulphur, alone or with lead arsenate, appeared to repel the adults. Although relatively unimportant, *Dendroctonus terebrans*, Ol., and *D. valens*, Lec., have caused unsightly damage to pitch pine (*P. rigida*) on Cape Cod, Massachusetts, during the past two or three years, and more injurious species may be attracted to the damaged trees. Other bark-beetles that have increased considerably throughout the hurricane area include *Ips pini*, Say, on white pine (*P. strobus*) and *P. rigida*, *I. calligraphius*, Germ., on *P. strobus*, *I. grandicollis*, Eichh., on *P. resinosa*, and *I.* (*Orthotomicus*) *caelatus*, Eichh., on Himalayan pine (*P. excelsa*). In addition, the true cambium borers, such as *Agrilus bilineatus*, Weber, on various oaks and *A. anxius*, Gory, on birches, have increased locally and killed many trees.

McIntyre (H. L.). **The present Threat of westward Spread of the Gipsy Moth.**—*J. econ. Ent.* **35** no. 2 pp. 171–173. Menasha, Wis., 1942.

The author discusses the success attained in preventing the western spread of the gipsy moth [*Lymantria dispar*, L.] in the United States by means of the barrier zone [*cf. R.A.E.*, A **28** 340] and the control of small outbreaks in Pennsylvania and New York. He points out that the most extensive spread recorded took place in 1939 and emphasises the importance of maintaining the barrier zone [*cf.* **29** 212 ; **30** 463]. He considers that there will be no difficulty in doing this effectively provided that intensive survey and treatment in the infested part of the zone in New York and extensive survey west of the Hudson River and at a few other points in or adjacent to New York, where conditions are favourable for the development of serious outbreaks, are initiated immediately.

Hamilton (C. C.). **The Taxus Mealybug,** *Pseudococcus cuspidatae* **Rau.**—*J. econ. Ent.* **35** no. 2 pp. 173–175, 1 fig., 4 refs. Menasha, Wis., 1942.

Pseudococcus cuspidatae, Rau, has been a serious pest of *Taxus* in New Jersey for several years, and in some instances is so abundant by midsummer that it almost covers the trunk and principal branches. Its feeding does not cause any deformation of the plant tissues, but continued heavy infestations stunt the growth and result in the death of the foliage. It infests all species of *Taxus*, but is most abundant on those having dense foliage. The adult female is described, and characters are given distinguishing living females from those of *P. comstocki*, Kuw., which also occurs on *Taxus*, *P. gahani*, Green, and *Phenacoccus gossypii*, Tns. & Ckll. This mealybug passes the winter in the first instar [*cf. R.A.E.*, A **26** 226]. In early April 1941 there were only a few living mealybugs on plants that had been heavily infested in 1940 ; they were still scarce at the end of May, but had increased considerably by mid-June, when nearly mature females were found. The increase was rapid during the summer, and there are probably two or three generations during the year ; the adults begin to disappear in September. The females were parasitised by unidentified Hymenoptera.

Sprays of proprietary materials containing rotenone, rotenone and oil, or rotenone, pyrethrum and oil gave approximately 90–95 per cent. mortality when applied thoroughly in June 1940 ; a spray of Loro (a thiocyanate) with Grasselli Spreader and Sticker (2 : 1 : 1,600), and one of nicotine sulphate (1 : 400) with 0·4 per cent. soap gave 98 and more than 99·5 per cent. control, respectively. A miscible tar-distillate spray also gave satisfactory control without injuring the plant when applied in summer.

Schwardt (H. H.). **Control of native White Grubs in young Hemlocks.**—*J. econ. Ent.* **35** no. 2 pp. 176–177, 1 fig., 1 ref. Menasha, Wis., 1942.

The author summarises the results obtained in a series of soil treatments applied during the summer of 1941 to young hemlock [*Tsuga*] for the control of larvae of *Lachnosterna* (*Phyllophaga*), outbreaks of which have occurred in several parts of New York during the past few years, causing severe damage to young evergreens in nurseries and reforestation plantings. Injury to young hemlock is characterised by a sudden and rapidly progressing yellowing of the leaves, which begin to drop about two weeks later, when all the fibrous roots and the bark of the larger roots and crown nearly to the soil line have been consumed. As three or four second-year larvae, which feed for about four months, can probably kill a three-year-old tree in less than a month, a population of 1 per sq. ft. is potentially very destructive.

Each three-year-old tree was treated on 23rd June with 50 gm. of a mixture of lead arsenate and sand (1 : 20 or 1 : 40), applied by taking up the tree, shaking the soil from the roots and sprinkling the mixture over the roots and in the hole to which the tree was to be returned, with 1 U.S. quart of a dilute emulsion containing 1 c.c. dichloroethyl ether emulsified with Aresklene, alone or with 1 c.c. methyl bromide, applied in a small depression round the tree and covered with dry soil, or with 5 gm. paradichlorobenzene crystals, applied in a ring 10 ins. in diameter and 2 ins. deep round the base of the tree and covered. Counts of healthy trees made at intervals until 2nd October showed that all treatments resulted in significantly higher survival than occurred in the control plots, but the only significant difference among the treatments was between lead arsenate and sand (1 : 40) and dichloroethyl ether ; the former and paradichlorobenzene resulted in average percentage survivals of 80 and 79, respectively, as compared with 57 for dichloroethyl ether and 29 in the control plots. The higher dosage of lead arsenate gave slightly lower survival (70 per cent.), possibly indicating a small decrease in resistance. Most of the trees that died did so between 11th July and 31st August, after which the rate of kill decreased in all plots, indicating that the normal summer feeding period of the larvae ends at about this time. Both the lead arsenate treatments caused a slight yellowing of the tips of the leaves, but no retardation of growth was noticed, and dead trees in these plots were all killed by the insects. No injury was observed from any of the other treatments. If cost and ease of application as well as efficiency are considered, paradichlorobenzene is the best of the insecticides tested, and a slightly larger dosage applied earlier in the season would probably give better protection.

BUCHANAN (W. D.) & SMUCKER (S. J.). **Reactivation of *Ceratostomella ulmi* in occluded Infections and Contamination of** *Scolytus multistriatus*.—*J. econ. Ent.* **35** no. 2 pp. 178–180, 2 refs. Menasha, Wis., 1942.

Since it has been found that many elm trees apparently recover from the Dutch elm disease, caused by *Ceratostomella ulmi*, and cannot be distinguished by external appearance from uninfected trees, but are susceptible to reinfection by inoculation or by the crossing of occluded infections into the vascular system of the current season, the relation of injuries made by *Scolytus multistriatus*, Marsh., to the reactivation of occluded infections in elm trees was investigated. Only one of over 200 trees that had been inoculated with the fungus in 1936 and 1938 and had recovered from the disease developed external symptoms after receiving feeding injuries from 11,400 uncontaminated beetles that were allowed to feed under controlled conditions in 1938–40, and similar symptoms developed in three of the control trees that were not exposed to the beetles. After the beetles had fed on the trees for a week or more, uncontaminated trap logs were provided. The fungus was isolated from four of 529 beetles that were collected while feeding in the twig crotches and trunks of the trees and in oviposition galleries they were making in the logs, but not from any of the 220 galleries that were cut out of the logs and cultured. It was also isolated from three of 234 beetles that were taken while they were feeding in the twig crotches of trees with a current infection and from three of 15 oviposition galleries in one tree that had both occluded infections (one and two years old) and an active one. Thus, although it was shown that adults of *S. multistriatus* can become contaminated with *C. ulmi* as a result of their feeding in the trunks and crotches of elms with either active or occluded infections, their effect on the reaction of occluded infections is not certain.

HETRICK (L. A.). **Some Observations of *Ips* Bark Beetle Attack on Pine Trees.**—*J. econ. Ent.* **35** no. 2 pp. 181–183, 2 figs., 6 refs. Menasha, Wis., 1942.

During the last three years, many small scattered groups of dying pine trees have been observed in eastern Virginia and studies were made on the species of *Ips* attacking them and the reasons for their attractiveness to Scolytids.

The species commonly responsible for primary attack were *I. calligraphus*, Germ., on large, thick-barked loblolly pine (*Pinus taeda*), and *I. avulsus*, Eichh., on smaller, thin-barked pine trees, especially Virginia scrub pine (*P. virginiana*, Mill.) ; *I. grandicollis*, Eichh., and *I.* (*Orthotomicus*) *caelatus*, Eichh., which may occasionally attain the status of primary bark-beetles, were usually of secondary importance and were found with the first two. Trees injured by lightning are usually very attractive to these beetles, but those damaged during cutting operations are not generally attacked unless injury is severe, as the tops of felled trees are more attractive. Pines injured by serious surface and crown fires do not appear to be generally attractive, but those in woods that have suffered ground fires, which may damage the roots without burning the trunks or crowns, are frequently killed. Many attacks on growing trees have been traced to root injury, other forms of which include severing during digging operations, wave action and salt-water flooding, and many group-killings of growing trees that cannot be attributed to any known cause are probably due to some unknown root condition that renders the trees attractive to the beetles. Pulpwood storage yards, sawmill sites and any freshly felled pine trees provide reservoirs of infestation. The beetles reproduce in the fresh cambium tissues, and the life-cycle may last less than three weeks in summer, so that large numbers may develop and infest growing pines round the storage yards and in localities where sawmill operations have been suspended. The summer cutting of pine pilings and pulpwood is less important, as the attractive portions of the trees are rapidly removed from the woods.

WENE (G.) & DOMINICK (C. B.). **Laboratory Tests with Insecticides against the Tobacco Flea Beetle.**—*J. econ. Ent.* **35** no. 2 pp. 183–184, 1 ref. Menasha, Wis., 1942.

The authors describe laboratory studies on the toxicity of various insecticides to adults of *Epitrix parvula*, F. Natural cryolite, Dutox (a commercial product containing 72 per cent. barium fluosilicate and 8 per cent. sodium fluoaluminate), lead arsenate, basic copper arsenate and phenothiazine [thiodiphenylamine], containing 90, 80, 97, 100 and 90 per cent. active ingredients, respectively, were applied in water to tobacco leaves, at dilutions of 1 : 50, 1 : 100 and 1 : 200, so as to give deposits of 0·0126, 0·0063 and 0·0032 mg. per sq. cm. leaf surface. Derris containing 2·8 per cent. pure rotenone and 5·2 per cent. derris resin was tested at these dilutions and also at 1 : 400, 1 : 800, 1 : 1,200, 1 : 1,600 and 1 : 2,000. Beetles were then enclosed on the sprayed surfaces. Of beetles confined on untreated leaves 1·5 and 6·7 per cent. were dead after 24 and 72 hours. Derris was much the most effective insecticide, giving 99·12 per cent. mortality after 24 hours at a dilution of 1 : 50 and 84·8 per cent. after 72 hours at 1 : 1,200 ; there was little or no feeding on leaves treated with it, indicating that it probably acts by contact. At 1 : 50 basic copper arsenate, cryolite, Dutox, lead arsenate and phenothiazine gave 80·89, 55·67, 59·57, 39·30 and 8·29 per cent. mortality in 72 hours, but the weaker arsenical sprays were much less effective. The leaves treated with the two higher concentrations of cryolite, Dutox and basic copper arsenate showed little feeding, indicating that the poisons were distasteful, but the beetles fed on all leaves treated with lead arsenate or phenothiazine.

BARE (C. O.). **Some natural Enemies of Stored-tobacco Insects, with biological Notes.**—*J. econ. Ent.* **35** no. 2 pp. 185–189. Menasha, Wis., 1942.

Since it was considered that the variation in the annual population of *Lasioderma serricorne*, F., and *Ephestia elutella*, Hb., the principal pests of stored tobacco in the United States, might be due to the action of parasites and predators, collections and observations were made in open and closed tobacco warehouses in Virginia and North Carolina in 1939 and 1940, and the life-histories of several species were studied in the laboratory. *L. serricorne* was parasitised by *Aplastomorpha calandrae*, How., *Lariophagus distinguendus*, Först., and *Chaetospila elegans*, Westw., the first two of which attacked both larvae and pupae, and *E. elutella* by *Microbracon hebetor*, Say, and *Nemeritis* (*Idechthis*) *canescens*, Grav., both of which attacked the larvae, and *Mesostenus gracilis*, Cress., which oviposited only in the cocoons or naked pupae; *A. calandrae* and *Microbracon hebetor* were the most important. *Tenebroides mauritanicus*, L., a species of *Seiulus* and one of *Monieziella*, probably *M. angusta*, Banks, were predacious on *Lasioderma*, and *Orius insidiosus*, Say, an undetermined species of *Seiulus*, two of *Cheyletus* and spiders belonging to six genera, of which *Salticus scenicus*, Cl., and *Theridion tepidariorum*, Koch, were the most important on *Ephestia*. Of these, *Monieziella* was an important enemy of *Lasioderma* and *Seiulus* and *Cheyletus* of *Ephestia*, but the other predators were of only incidental importance. None of the natural enemies discussed, however, was observed to cause a large reduction in the numbers of its host. Data are included on mating, oviposition, sex ratios, rates of development and the number of generations a year of most of the species dealt with.

TENHET (J. N.) & REED (W. D.). **Fumigation of open-type Tobacco Warehouses.**—*J. econ. Ent.* **35** no. 2 pp. 190–193, 3 figs., 1 ref. Menasha, Wis., 1942.

The authors discuss the difficulty of controlling *Lasioderma serricorne*, F., and *Ephestia elutella*, Hb., in tobacco stored in open warehouses and describe a method of sealing such buildings for fumigation with curtains of gasproof, rubber-coated cloth [*cf. R.A.E.*, A **30** 592]. To test its efficiency, samples of various stages of *E. elutella* and *L. serricorne* were placed in the air spaces and in the tobacco bales in warehouses in Virginia, and fumigation was carried out with hydrocyanic acid gas at a dosage of 6 oz. per 1,000 cu. ft. for 48 hours at summer temperature (87°F.). As the insects in the air spaces were killed, but penetration of the tobacco was inadequate, the dosage was increased to 12 oz. per 1,000 cu. ft. for 50 hours, which killed all the adults and eggs of the beetle and the eggs and larvae of the moth in the free spaces, but did not give complete mortality of the eggs and larvae of *Ephestia* at depths of 1–5 ins. in the tobacco or of the eggs of *Lasioderma* at a depth of 5 ins.

BIBBY (F. F.). **Cotton Insect Investigations in Peru.**—*J. econ. Ent.* **35** no. 2 pp. 193–197, 3 figs. Menasha, Wis., 1942.

An account is given of investigations carried out in Peru between September 1938 and March 1939 on the control of insect pests of cotton, chiefly *Aphis gossypii*, Glov. Infestation by the Aphid was relatively unimportant in spring, but serious in summer, apparently owing to the use of arsenicals, principally calcium arsenate dust, for the control of the Noctuids, *Alabama argillacea*, Hb., and *Anomis texana*, Ril., and an attempt was therefore made to find substitutes for the arsenicals. When dusts of cryolite and sulphur (20 : 80), Paris green and sulphur (25 : 75) and calcium arsenate were applied three times at weekly intervals after the spring Aphid infestation and before the Noctuids became injurious, Aphid infestation was negligible in the control plots 2 and 3 weeks after the last application, little higher in those receiving cryolite, but severe in those receiving Paris green or calcium arsenate. In January, when both Noctuids and *Anthonomus vestitus*, Boh., were present, the cryolite dust was rather less effective than calcium arsenate against the former [*cf. R.A.E.*, A **29** 510], though it gave satisfactory control, and equal or superior to it against the weevil. In further tests, dusts containing 0·75 per cent. rotenone from cubé, with sulphur or an inert carrier, pyrethrum (0·1 per cent. pyrethrins) in sulphur. (25 : 75), Paris green and sulphur (20 : 80), cryolite and sulphur or calcium arsenate were applied in January and February; Paris green gave complete control of the Noctuids, and the others, with the exception of pyrethrum, which was useless, were quite effective; rotenone gave rather better results with sulphur than with the inert dust. Aphid infestation became severe on the plots that received the arsenicals, but was negligible on the others. Although plants that were sprayed with calcium arsenate were less attacked by Aphids than those that were dusted with it, dusting is considered to be preferable under conditions in Peru. Of three insecticides that were applied in February to plots heavily infested with the Aphid, 1·2 per cent. rotenone in sulphur gave excellent control, and pyrethrum flowers (0·1 per cent. pyrethrins) and sulphur (25 : 75) was rather less effective, but much better than a mixture of nicotine sulphate and calcium arsenate containing 2 per cent. nicotine. It is, therefore, likely that the spring Aphid infestation could be controlled with sulphur containing 1–1·5 per cent. rotenone. An outbreak of *Leucothrips piercei*, Morg., was effectively controlled in October by the application of dusting sulphur alone or with nicotine sulphate to provide 2 per cent. active nicotine.

LATHROP (F. H.). **The Blueberry Thrips.**—*J. econ. Ent.* **35** no. 2 pp. 198–201, 3 figs., 1 ref. Menasha, Wis., 1942.

Frankliniella vaccinii, Morg., which has been known as a pest of low-bush blueberries in Maine since 1926, occurs rather generally throughout the blueberry-growing areas of the State and has been observed in one locality in western New York; infestation is light to moderate in most places, but severe enough to reduce the crop materially in a few of them. The adults appear as soon as the first leaves begin to separate in the buds, sometimes as early as 26th May; the leaves of infested buds remained rolled round the central axis of the cluster, and the thrips live within the tightly rolled leaves. Eggs are first observed in the leaf tissue when the plants come into bloom, usually in the first week of June, and are abundant and beginning to hatch by mid-June, when blooming is about over. The nymphs increase in numbers until about the middle of July, after which adults become increasingly numerous until the end of July, when they begin to enter hibernation; all thrips have disappeared from the plants by the last week in August.

The results of experiments on the control of this thrips, carried out each season since 1936, are summarised. Treatment during the period of emergence with dusts containing cubé or derris, sulphur, or nicotine and lime or a spray of tartar emetic and brown sugar, applied to the plants, or with flake naphthalene or poisoned bran bait, scattered on the ground, and burning over infested areas during June and July with a kerosene torch were ineffective [*cf. R.A.E.*, A **26** 333; **29** 165]. An emulsion of 12 U.S. pints kerosene, ¾ lb. soap and water to make 24 U.S. gals., sprinkled on the soil at the rate of 1 U.S. gal. per sq. yd. by means of a watering can during late autumn, early spring or both, when the thrips were dormant, showed promise. Dichloroethyl ether and an emulsion of ethylene dichloride applied in the same way were of little value, and carbon-bisulphide emulsion appeared to cause an increase in the number of infested plants. The kerosene caused severe damage to the plants when applied in both autumn and spring but not when applied once at either period, and none of the other treatments was injurious.

PEPPER (B. B.). **Studies of the Mite *Epitrimerus hystrix* Nalepa on Timothy.**—*J. econ. Ent.* **35** no. 2 pp. 201–204, 3 figs., 7 refs. Menasha, Wis., 1942.

Fields of timothy grass [*Phleum pratense*] in a locality in New Jersey were showing serious injury in the spring of 1938, and plants from the damaged area were found to be heavily infested with a mite, later identified as *Epitrimerus (Callyntrotus) hystrix*, Nal. By 1941, infestation had spread to every county in the State, but although many different grasses and small grains were examined, orchard grass (*Dactylis glomerata*) was the only other food-plant found. Most of the mites occurred on the upper surfaces of the unfolding leaves of timothy grass, and in severe infestations the growing tip of the plant was killed, so that the leaves did not unfold, and often the entire vegetative portion of the plant died. The adults overwinter on the living tissues in the crown of the plants, and the eggs are laid in the grooves of the upper leaf surface. Both eggs and young nymphs are present during the latter part of February and early March. Hot summer weather appears to retard development, and the population is greatly reduced after the first crop of hay is cut and remains rather small until late August and early September, when it begins to increase rapidly. During November, adults are plentiful and eggs and nymphs are usually present. Isolated females deposited 52–81 eggs in six days, and the eggs hatched in 5–6 days under room conditions.

Burning over the sod before growth began in spring did not give more than about 60 per cent. control under the most favourable conditions and apparently injured the root system. Of insecticides tested in 1940, sprays containing Orthol K summer oil emulsion or dormant oil emulsion (0·75 and 1·5 per cent. actual oil) and two dinitro dusts caused severe injury to the grass, and 1 per cent. rotenone dust was ineffective against the mites, but sulphur dust, applied at 40 lb. per acre, and calcium cyanamide, at 100 lb. per acre, showed promise and were tested again in 1941. In this year, sulphur dust, applied at 50 lb. per acre, gave good control of the mites, but resulted in a low yield as compared with pulverised calcium cyanamide, at 100, 200 or 300 lb. per acre. The latter was applied by three different methods, which are described ; it did not give satisfactory control of the mites at 100 lb. per acre, but the 200 lb. dosage was almost as effective as the higher one. It is concluded that the cyanamide acts not only as a contact poison for the mite but also as a fertiliser for the crop.

WORTHLEY (H. N.) & FREAR (D. E. H.). **Deposition of Lead from Lead Arsenate Spray Mixtures and its Retention on Pyralin Plates and Apple Leaves and Fruits.**—*J. econ. Ent.* **35** no. 2 pp. 205–210, 2 figs., 10 refs. Menasha, Wis., 1942.

An account is given of investigations to compare the deposition and retention of lead arsenate on plates of Pyralin in the laboratory with those on apple leaves and fruit in the field. Pyralin is a cellulose nitrate plastic film and was chosen because macroscopic examination had indicated that the amounts deposited on this surface were similar to those on certain natural plant surfaces. The sprays contained acid lead arsenate alone or with numerous supplementary materials. The residues on the plates were analysed for lead immediately after spraying and after washing the dried plates with different quantities of water, and those on the foliage and fruit immediately after spraying and after intervals of approximately 2–7 weeks, during which the rainfall was recorded. It was found that the order of the treatments as regards both deposition and retention of lead varied on the three surfaces used, but some treatments were consistently among the best and others consistently among the worst of those tested.

PEARCE (G. W.), CHAPMAN (P. J.) & AVENS (A. W.). **The Efficiency of dormant Type Oils in Relation to their Composition.**—*J. econ. Ent.* **35** no. 2 pp. 211–220, 2 figs., 17 refs. Menasha, Wis., 1942.

The following is substantially the authors' summary of the results of an investigation in New York, part of which has already been noticed from a short account [*cf. R.A.E.*, A **30** 572]. A study was made of the insecticidal efficiency of 39 petroleum oils of the dormant type, using eggs of *Tortrix* (*Cacoecia*) *argyrospila*, Wlk., on apple trees for most of the tests, and correlations between efficiency of control and various properties related to the constitution of the oils were observed. Data on viscosity, viscosity index, unsulphonated residue, density, refractive index, specific refraction, specific dispersion and the "Waterman analysis" are given for each oil. Evidence based on these data shows that an oil that is highly paraffinic in character and probably low in aromatic structures is the most desirable type for use against *T. argyrospila.* Theoretical and practical implications of the results of the study are discussed.

SCHOENE (W. J.). **Orchard Sprays and the White Apple Leafhopper.**—*J. econ. Ent.* **35** no. 2 pp. 220–222, 4 refs. Menasha, Wis., 1942.

As earlier investigations in Virginia had shown that *Typhlocyba pomaria*, McAtee, was not abundant on apple trees in unsprayed orchards, but was often numerous on trees with a heavy deposit of spray, experiments to determine the effect on it of sprays commonly used on apple were carried out in the laboratory in 1934–40. Adults of both sexes were placed on small apple trees that had been thoroughly sprayed between 7th and 14th June, and further sprays were applied with an atomiser when oviposition was complete, but before hatching began, usually about 24th July, and in some cases again a few days later. The results indicated that one application of Bordeaux mixture (2 : 4 : 50), lead arsenate (3 lb. per 100 U.S. gals. water), a combination of the two or lime-sulphur had very little influence on the development of the nymphs, since almost as many progeny per female were produced as on the control trees, but very few nymphs developed on foliage sprayed with stronger Bordeaux mixture (4 : 4 : 50). When one additional spray was applied just before the eggs hatched, the number of nymphs was reduced by more than 50 per cent., and a second one reduced it still further. In 1941, nicotine sulphate was tested as an ovicide and was found to cause an appreciable reduction in the numbers of nymphs at dilutions as low as 1 : 800. During this experiment, numbers of immature spiders on the leaves were observed to feed on the nymphs. It is concluded that the fungicides in common use are not beneficial to the leafhoppers unless they protect them from fungi, and may reduce the numbers that mature. The deposit on the foliage of heavily sprayed trees in commercial orchards is chiefly on the upper surface of the leaves, on which the nymphs do not feed.

HARMAN (S. W.). **Studies on Rotenone and other organic Insecticides for Codling Moth Control.**—*J. econ. Ent.* **35** no. 2 pp. 223–224. Menasha, Wis., 1942.

The results are given of a series of field experiments carried out during 1938–41 in which rotenone-bearing materials and certain other organic compounds were tested against the codling moth [*Cydia pomonella*, L.] on apples under conditions of severe infestation in New York [*cf. R.A.E.*, A **30** 570]. The percentage control was estimated from the percentages of apples infested on sprayed and untreated trees; the quantities of insecticides given are those used per 100 U.S. gals. water. In 1938, sprays containing 3 lb. lead arsenate, 4 lb. ground cubé root (4 per cent. rotenone) or ½ U.S. pint nicotine sulphate (Black Leaf 40) with 3 U.S. quarts summer oil gave 96, 54 and 88 per cent. control, respectively; and in 1939, a proprietary rotenone spray gave less than 50 per cent. control. In 1940, five cover sprays of each material tested were applied after two cover sprays of lead arsenate, and the control percentages were 82·5 for 5 lb. derris with 1 U.S. quart summer oil; 75 for 1 U.S. quart of a rotenone extract stated to contain 18 per cent. active ingredients; 70·8 for 1 U.S. quart extract containing 2·8 per cent. rotenone; 98·2 for 3 lb. lead arsenate; 82·9 for a fixed nicotine (3 lb. Black Leaf 155) alone; 96·2 for the fixed nicotine with the addition of 2 U.S. quarts oil in the first-brood sprays; and 98 for ½ pint nicotine sulphate with oil (2 U.S. quarts against the first brood and 1 U.S. quart against the second). In one orchard in 1941, six cover sprays of the materials tested followed two of lead arsenate. The control percentages and (in brackets) the percentages of apples showing superficial injury were 98·5 (4·6) for ½ U.S. pint nicotine sulphate with 3 U.S. pints oil; 96·9 (2·2) and 99·5 (1) for two fixed nicotines (1½ lb. Black Leaf Concentrate and Black Leaf Micronised) with 2 U.S. quarts oil; 95·5 (7·8) for 2½ lb. derris (4·8 per cent. rotenone) with 1 U.S. quart oil; 97·4 (22·3) for 3 lb. lead arsenate; and 78·6 (44·8) for 1. U.S. gal. rotenone extract containing 0·61 per cent. rotenone. The corresponding figures for another orchard were 96·5 (6) for two cover sprays of 3 lb. lead arsenate and four of ½ pint nicotine sulphate with 2 U.S. quarts oil; 97·7 (21·2) for four of 3 lb. lead arsenate and two of fixed nicotine (3 lb. Black Leaf 155 Concentrate); 97·4 (9·4) for one of 3 lb. lead arsenate and five of 1 lb. lead arsenate with 1 U.S. pint nicotine sulphate; and 99·1 (5·4) for one of 3 lb. lead arsenate and five of 1 lb. lead arsenate with 2½ lb. derris (4·8 per cent. rotenone) and 1 U.S. quart oil. It is concluded that powdered derris root with oil is more effective against *C. pomonella* than rotenone extracts and that sprays containing a small quantity of lead arsenate with nicotine sulphate or powdered derris root and oil give effective control.

SIEGLER (E. H.) & JONES (H. A.). **Extracts of Apple Peels as Adjuvants to Lead Arsenate against the Codling Moth Larva.**—*J. econ. Ent.* **35** no. 2 pp. 225–226, 3 refs. Menasha, Wis., 1942.

In view of the increase in toxicity of sprays of lead arsenate to larvae of *Cydia* (*Carpocapsa*) *pomonella*, L., obtained under laboratory conditions by the addition of certain sugars, which may induce the newly hatched larvae to feed on the poisoned surface of the apple [*cf. R.A.E.*, A **29** 129], preliminary experiments were carried out by the apple-plug method to ascertain the effect of adding extracts of peel from ripe and unripe apples in ethyl alcohol to sprays of lead arsenate to give a concentration of 20 per cent. alcoholic extract by volume. Statistical analysis of the percentages of larvae surviving indicated that the effectiveness of the spray was significantly increased by extracts containing 70–565 mg. per cc. of non-volatile extractives from either ripe or green fruit, but not by those containing only 12–35 mg.

CARRUTH (L. A.). **An Investigation of the Mineral Oil Treatment for Corn Earworm Control.**—*J. econ. Ent.* **35** no. 2 pp. 227–233, 1 fig., 15 refs. Menasha, Wis., 1942.

The following is based on the author's summary of this account of investigations on Long Island in 1938–41 on the control of *Heliothis armigera*, Hb., on commercially grown sweet maize by the injection of mineral oil into the silk channels of the ears, recommendations based on which have already been noticed [*R.A.E.*, A **30** 568]. The treatment provided a more nearly satisfactory means of control than methods previously investigated, and special techniques were developed for the application of the oil and the recording of experimental data. A mineral oil of the highest degree of refinement commercially available, with a viscosity between 175 and 210 secs. Saybolt at 100°F., was found most satisfactory for general use, since oils of lower viscosities produced excessive stunting of the ear tips, though oils with viscosities as low as 125 secs. may prove to be permissible as lower effective dosages per ear are established. A single treatment at a dosage between 0·5 and 0·6 cc. per ear should give relatively good control, and dosages as low as 0·25 cc. proved effective in certain experiments. A preliminary investigation indicated that oils of slightly less refinement did not differ significantly in performance from oils of the highest quality, although they should probably not be used without further investigation. The addition of an insecticide increased the effectiveness of the oil treatment and did not significantly increase the amount of ear-tip stunting at ordinary dosages. Relatively good control was obtained with oil containing as little as 0·1 per cent. pyrethrins or 1 per cent. dichloroethyl ether, though double these quantities are usually suggested [*cf.* **30** 267, etc.]. Treatments with oil and insecticide applied 5–7 days after silking were relatively effective, and treatments applied even later gave relatively good control in certain tests, although a danger of greater injury by the larvae was found when heavy infestations were present.

WATKINS (T. C.). **Toxicities of Bordeaux Mixture, Pyrethrum and Derris, to Clover Leafhoppers.**—*J. econ. Ent.* **35** no. 2 pp. 234–236, 1 fig., 3 refs. Menasha, Wis., 1942.

The following is substantially the author's summary. The results are given of a series of tests in which adults of the clover leafhopper, *Aceratagallia sanguinolenta*, Prov., were immersed in Bordeaux mixture and aqueous suspensions of pyrethrum and derris. Bordeaux mixture has been found to reduce populations of this Jassid on clover in New York [*R.A.E.*, A **30** 410], but it showed no toxicity as a contact insecticide. The greatest kill obtained with derris was 52 per cent. at a concentration equivalent to 16 lb. powder containing 5 per cent. rotenone per 100 U.S. gals., whereas 100 per cent. kill with pyrethrum was obtained at a concentration equivalent to 4 lb. ground flowers containing 0·5 per cent. pyrethrins per 100 U.S. gals. Dosage-mortality curves for the results of tests with pyrethrum and derris are presented, as are also comparisons of these results with those obtained in previous tests [**30** 261] on the potato leafhopper [*Empoasca fabae*, Harr.].

LINCOLN (C. G.). **Pellet Bait for Control of the Alfalfa Snout Beetle.**—*J. econ. Ent.* **35** no. 2 pp. 236–237, 1 ref. Menasha, Wis., 1942.

In tests carried out in 1940 in northern New York, a bait of soy-bean flour, granulated sugar and sodium fluosilicate (100 : 15 : 6) moistened with water gave promising results against *Otiorrhynchus* (*Brachyrrhinus*) *ligustici*, L., in the laboratory [*cf. R.A.E.*, A **30** 387], but was ineffective in the field. When it was compressed into rather firm pellets, however, it was more effective in field cages in lucerne or on ploughed ground than baits made with fine or coarse soy-bean flour or maize cobs and comparable with raisin bait. Further tests in field cages and plots in 1941 confirmed the effectiveness of this method of treating the bait, which conserves its moisture under the unfavourable climatic conditions common in April and May and makes it easy for the weevils to find.

LINCOLN (C. G.), SCHWARDT (H. H.) & PALM (C. E.). **Methyl Bromide-Dichloroethyl Ether Emulsion as a Soil Fumigant.**—*J. econ. Ent.* **35** no. 2 pp. 238–239, 1 ref. Menasha, Wis., 1942.

As investigations in New York on the possibility of eradicating the alfalfa snout beetle [*Otiorrhynchus ligustici*, L.] from small newly infested areas by soil fumigants applied in late summer or early autumn [*R.A.E.*, A **29** 198] showed that methyl bromide injected at a depth of 8 inches and a rate of 272 lb. per acre gave complete control of the adults, which are at a depth of about 12 inches at that season, but failed to kill larvae in the upper 4 inches of soil, further investigations were carried out. Surface applications of methyl bromide in methyl alcohol (1 : 5) were ineffective, but an emulsion of equal volumes of methyl bromide and dichloroethyl ether in the same volume of water containing 3 per cent. Aresklene (by weight) gave complete and consistent kill of larvae and adults at all levels down to 18 ins. when sprinkled on the soil at the rate of 450 cc. stock emulsion diluted with 5 U.S. gals. water per 100 sq. ft. on 26th September 1940. Various amounts of water were sprinkled on the plot, after the fumigant was applied to seal the soil surface and assist penetration ; 10 U.S. gals per 100 sq. ft. appeared to be sufficient. A second test, made in mid-October, showed that 450 cc. per 100 sq. ft. was approximately the minimum effective dosage ; 300 cc. was inadequate, and 600 cc. is probably advisable. At 450 cc. the emulsion caused noticeable stunting of lucerne.

BLANTON (F. S.). **Methyl Bromide Fumigation for Control of the Narcissus Bulb Fly.**—*J. econ. Ent.* **35** no. 2 pp. 239–241. Menasha, Wis., 1942.

At a temperature of 70°F., fumigation with methyl bromide resulted in complete mortality of the larvae of *Merodon equestris*, F., in narcissus bulbs at dosages of 4½ lb. per 1,000 cu. ft. for 2 hours, 4 lb. for 2½–3 hours and 2½ and 3 lb. for 4 hours. Mortality was lower at 80°F., but in this case the bulbs were cold at the beginning of the treatment ; with the longer exposures, the bulbs reached the required temperature, and higher mortality occurred. When bulbs at temperatures of 39–54°F. and others at 72–86° were fumigated at 80°, there was no appreciable difference in mortality after exposure for 2 hours, but it was higher on the warm bulbs at longer exposures, indicating that the temperature of the bulbs should be 70° before fumigation is begun. The larvae of *Eumerus tuberculatus*, Rond., and all stages of *Rhizoglyphus hyacinthi*, Banks, were killed at all dosages and exposures that were lethal to *M. equestris*. Treatment during the dormant season with 2½ or 3 lb. methyl bromide per 1,000 cu. ft. for 4 hours at 70°F. had no significant effect on the flowering of the bulbs or their increase in weight.

RICHARDSON (H. H.) & CASANGES (A. H.). **Studies of Nicotine as an Insect Fumigant.**—*J. econ. Ent.* **35** no. 2 pp. 242–246, 1 fig., 15 refs. Menasha, Wis., 1942.

The authors describe laboratory investigations with an air-flow apparatus [*cf. R.A.E.*, A **26** 21] to determine the comparative resistance to nicotine vapour of 36 species of insects and a mite, and the effect of different food-plants on insect resistance, of exposure time and gas concentration on fumigation efficiency and of other factors. There was a wide variation in resistance, even among closely related insects. Susceptible species, with which complete mortality was obtained after exposure to concentrations of 0·003–0·025 mg. per litre for 30 minutes at about 77°F. included the ten Aphids used and three of five thrips and also adults of *Trialeurodes packardi*, Morrill, *Empoasca fabae*, Harr., *Aphidius phorodontis*, Ashm., and *Reticulitermes flavipes*, Koll., adults and larvae of *Cydia* (*Carpocapsa*) *pomonella*, L., and larvae of *Bombyx mori*, L. Complete mortality of several of the Aphids was obtained by fumigation for one minute at fairly high concentrations. Adults of *C. pomonella* were more susceptible than some of the Aphids. *T. vaporariorum*, Westw., was slightly more resistant, most of the beetles, and particularly *Tribolium confusum*, Duv., were resistant and the honey bee (*Apis mellifera*, L.) was one of the most resistant of the insects tested. *Myzus persicae*, Sulz., was very susceptible when reared on nasturtium, moderately so on climbing dahlia and resistant on turnip and lettuce. Other insects varied little in susceptibility when reared on different food-plants. Some insects showed considerable variation in resistance at different stages ; adults of *Taeniothrips simplex*, Morison, were less resistant then the nymphs, whereas those of *Thrips nigropilosus*, Uzel, were much more so, and nearly mature larvae of *Laphygma* (*Prodenia*) *eridania*, Cram., and *Heliothis armigera*, Hb., were much more resistant than very young ones, whereas there was little difference in the case of *B. mori*. There was little change in the resistance of *M. persicae* and *C. pomonella* at different times of the year, but there appeared to be some change with *Aphis rumicis*, L., *Macrosiphum* (*Macrosiphoniella*) *sanborni*, Gill., and

Tribolium confusum. No constant relation was found between the concentrations of gas required for 50 and 95 per cent. mortality, and because of its greater practical value, the concentration for 95 per cent. is considered preferable for making comparisons of resistance. Gas concentration affected efficiency more than did exposure time, short exposures to high concentrations being more effective than proportionately long exposures to low concentrations. This relationship appeared to be fairly constant for each of the four species tested over a limited range of exposures. Comparison with published results of fumigation with hydrocyanic acid gas indicated that nicotine was much more toxic in the laboratory, but owing to disadvantages in the use of nicotine, such as its much lower vapour pressure, the dosages of the two fumigants generally recommended for the control of Aphids in the greenhouse are not very different.

HEAL (R. E.). **Evaluating Protection of Fabrics from Clothes Moth and Carpet Beetle Attack.**—*J. econ. Ent.* **35** no. 2 pp. 249–255, 2 refs. Menasha, Wis., 1942.

The following is substantially the author's summary. Procedures are described for the maintenance of laboratory cultures of the webbing clothes moth, *Tineola bisselliella*, Humm., the black-carpet beetle, *Attagenus piceus*, Ol., and the furniture carpet beetle, *Anthrenus vorax*, Waterh., of known ages. A method is outlined for the evaluation of the degree of protection against attack by clothes moths and carpet beetles afforded to fabrics by various treatments by subjecting them to the feeding of larvae of these species under carefully controlled conditions. Data are presented to show that the resistance of a treated fabric to attack by the larvae of any single species does not ensure that it is effectively protected against attack by other species.

QUINBY (J. R.) & GAINES (J. C.). **The Effect of Parasites and Predators on Corn Earworms in Sumac Sorgo Heads.**—*J. econ. Ent.* **35** no. 2 p. 264. Menasha, Wis., 1942.

In the course of a plant breeding experiment in Texas, heads of sorghum were enclosed in bags just before they began to bloom, and the bags were not removed until two weeks after blooming was completed. Corn earworms [*Heliothis armigera*, Hb.] destroyed 75 per cent. of the grains on these heads and they yielded an average of only 0·02 lb. seed each, as compared with a yield of 0·074 lb. per unbagged head. The difference was apparently due to destruction of the unprotected larvae by natural enemies, which must therefore be of considerable importance in reducing the damage that they cause to sorghum.

DITMAN (L. P.), VOGT (G. B.) & SMITH (D. R.). **The Relation of Unfreezable Water to Cold-hardiness of Insects.**—*J. econ. Ent.* **35** no. 2 pp. 265–272, 6 figs., 8 refs. Menasha, Wis., 1942.

The following is based on the authors' summary. Determinations of unfreezable water at various temperatures from above to below the undercooling range in overwintering larvae of *Pyrausta nubilalis*, Hb., *Cydia* (*Carpocapsa*) *pomonella*, L., and *Diatraea crambidoides*, Grote, pupae of *Heliothis armigera*, Hb., and adults of *Anasa tristis*, DeG., and in summer larvae of *P. nubilalis*, pupae of *H. armigera* and adults of *A. tristis* and *Epilachna varivestis*, Muls., showed that maximum freezing took place as soon as the undercooling points were reached. When frozen to temperatures below their undercooling range, there was remarkable uniformity in the percentage of unfreezable water in all species studied, and complete freezing of body water did not occur at temperatures as low as —40°. There was no relation between cold-hardiness and the percentage of total water unfreezable or the ratio of unfreezable water to dry weight when the insects were frozen below the undercooling temperature.

ROARK (R. C.). **The Examination of Plants for insecticidal Constituents.**—*J. econ. Ent.* **35** no. 2 pp. 273–275, 10 refs. Menasha, Wis., 1942.

The author considers that many organic compounds of great insecticidal value remain to be discovered in plants and that continued search for these is desirable, since new insecticides are needed to combat destructive insects against which no known material is wholly satisfactory; to reduce or eliminate the use of materials poisonous to man and domestic animals, and as substitutes for products that are no longer available owing to the war. He points out that most of the tests for insecticidal value that have hitherto been made with plants and plant extracts are of little value owing to failure to test the material on a susceptible insect (in view of the specific action of many organic compounds), to test suitable plant material, and to use the appropriate solvent for the extraction of insecticidal principles; and that to examine a plant adequately for insecticidal value it is necessary to have it identified by a specialist, to test it soon after it is collected, since many plant constituents deteriorate when the dried plant material is stored, to test the entire plant unless it is known that the active principles are localised in one part, to employ several species of insects, representative of different Orders, as test organisms, and to test the plant material as a contact poison, as a stomach poison and as a fumigant by the aerosol method, and in the form of a finely pulverised powder and as extracts made with different classes of organic solvents.

GINSBURG (J. M.), SCHMITT (J. B.) & REID (T. S.). **A Rotenone-bearing Variety of *Tephrosia virginiana* in New Jersey.**—*J. econ. Ent.* **35** no. 2 pp. 276–280, 19 refs. Menasha, Wis., 1942.

The following is taken from the authors' summary. Roots of plants of *Tephrosia virginiana* found growing wild in nine localities in New Jersey proved to be practically devoid of rotenone and low in total extractives, and showed very little toxicity to the insects on which they were tested. Seeds of two Texas varieties of *T. virginiana*, selected for their rotenone-bearing characteristics, were then planted in New Jersey soils, and the plants from them grew well and reproduced their characteristic of forming rotenone [*cf. R.A.E.*, A **30** 525]. The roots contained 0·76–1·4 per cent. rotenone and approximately 8–11 per cent. acetone extractives, and acetone extracts of them were highly toxic to several species of Aphids.

ESSIG (E. O.). **Woolly Apple Aphid infesting Apple Cores.**—*J. econ. Ent.* **35** no. 2 p. 281. Menasha, Wis., 1942.

The occasional finding in California of *Eriosoma lanigerum*, Hsm., in the cores of apples with unusually wide-open blossom ends was considered of no importance until October 1941, when canned apple juice from certain districts could not legally be sold because it contained body parts of this Aphid. It was found that 2–5 per cent. of the apples being used were infested in this way with from 1 to 20 individuals, and in some cases the opening had closed after the entrance of the Aphids, which, however, appeared to be unaffected; white woolly wax, honeydew and cast skins were usually present. Since there is no known means of eliminating infested fruits without cutting them open, and since the manufacturing process does not permit the use of screens sufficiently fine to exclude the insect parts and there is no machinery available for coring the fruit, it will be necessary for growers to control the Aphid to the extent of eliminating fruit infestation if the canning of juice from apples grown in these districts is to continue.

Walker (H. G.) & Anderson (L. D.). **Thiocyanate-derris Dusts for Control of Truck Crop Insects.**—*J. econ. Ent.* **35** no. 2 pp. 281–282. Menasha, Wis., 1942.

In an attempt to find a more reliable and economical means of controlling *Macrosiphum onobrychis*, Boy. (*pisi*, Kalt.) on peas in Virginia, dusts containing 1 per cent. rotenone as derris in talc, 0·4 per cent. rotenone as derris, and 2 per cent. Lethane 384 [which contains 50 per cent. butyl carbitol thiocyanate] in talc, and 3 per cent. nicotine as nicotine sulphate in hydrated lime were applied to infested plants on 26th October 1940. The average number of Aphids per plant on plants treated with these dusts were 44·7, 25·9 and 20·7, respectively, after 3 days, and 15·2, 25·4 and 71·7 after 7 days, as compared with 161·5 and 247·5 on untreated plants, the differences required for significance being 14·5 and 30·4. The dust containing derris and Lethane gave no control of the cabbage looper, *Plusia* (*Autographa*) *brassicae*, Ril.

In tests in the spring of 1941, dusts of derris and talc containing 0·6, 0·7 and 0·4 per cent. rotenone and 3, 1·8 and 2 per cent. Lethane 384, respectively, dusts of derris and pyrophyllite (1 per cent. rotenone), with or without 2 per cent. soy-bean oil, and one containing 1 per cent. rotenone as derris and 1 per cent. Vatsol O.S. in talc, applied to peas at the rate of about 50 lb. per acre by means of a tractor duster equipped with a 35 ft. cloth trailer, all caused significant reductions in the numbers of *M. onobrychis* but showed practically no significant differences between treatments after one, three or five days. The dusts of derris and Lethane gave practically no mortality of *Brevicoryne brassicae*, L., on cabbage, and owing to the difficulty of securing good coverage were less effective against *Myzus persicae*, Sulz., on spinach than a 3 per cent. nicotine dust.

Flanders (S. E.). **The Deposition of non-viable Eggs by Hymenoptera.**—*J. econ. Ent.* **35** no. 2 p. 283, 3 refs. Menasha, Wis., 1942.

Since fertilisation is not a pre-requisite, Hymenopterous eggs should be viable at the moment of deposition, but this is not the case when oviposition follows a period of several days during which the deposition of mature eggs held in the ovary is inhibited. Recent observations on parasitic Hymenoptera indicate that "regression" of an egg while in the ovary and its consequent loss of viability are environmentally induced, since when oviposition by a gravid female of *Metaphycus luteolus*, Timb., had been prevented for three weeks by withholding the host, the first three eggs that were deposited consisted of two that collapsed soon after deposition and had probably begun to deteriorate in the ovary and one that was normal. It has been shown in studies on a number of Hymenoptera that the ripe eggs in the ovary, while remaining more or less constant in number, are continually being absorbed with their egg follicles if ovulation is inhibited; eggs in the process of disintegration but with the chorion sufficiently intact to retain its fluid contents, can apparently be forced through the ovipositor. The process of oösorption, therefore, apparently accounts for the non-viable eggs (either haploid or diploid) deposited by Hymenoptera.

Medler (J. T.). **A convenient Cage for confining Insects to Plants.**—*J. econ. Ent.* **35** no. 2 pp. 283–284, 2 figs., 1 ref. Menasha, Wis., 1942.

The author describes the construction of a small cage from a short celluloid tube, covered at one end with bolting silk or gauze, in which individual insects can be confined on plant parts without apparent interference with the normal activity of the insect and without injury to the plants. The cage can be fastened against such plant parts as cotton bolls with adhesive tape, or over leaves or stems by cutting one slit from the open end to take the petiole or two for the stem and adjusting a cork in the end so that no space is left for the escape of the insect. The cage is light enough to be used on stems without support, but on petioles or leaflets it should be suspended by means of a bent pin in the cork.

WINGO (C. W.) & BROWN (H. E.). **Field Studies of Codling Moth Larval Attractants.**—*J. econ. Ent.* **35** no. 2 pp. 284–285, 1 ref. Menasha, Wis., 1942.

In view of the promising results obtained in the laboratory [*R.A.E.*, A **29** 129], brown sugar was added to sprays applied against larvae of the codling moth [*Cydia pomonella*, L.] on apple in orchard tests in Missouri in 1940 and 1941. In the first year, six cover sprays of lead arsenate and summer oil with the addition of 10 lb. sugar per 100 U.S. gals. reduced the percentages of apples infested and injured superficially to 6·2 and 31·7 as compared with 15·4 and 46·9 for the same sprays without sugar, but caused severe leaf-fall from about the middle of August. In 1941, the addition of 4 lb. sugar per 100 U.S. gals. appeared to increase the effectiveness of fixed nicotine (Black Leaf 155) and summer oil, lead arsenate and lead arsenate and summer oil as much as the larger amount in 1940, and caused no injury to the trees. The control given by phenothiazine [thiodiphenylamine] was not much affected by the addition of sugar. The addition of only 2 lb. brown sugar per 100 U.S. gals. to a lead-arsenate spray caused no significant difference in control.

MCINDOO (N. E.). **Insecticides derived from Plants.**—*J. econ. Ent.* **35** no. 2 pp. 285–286. Menasha, Wis., 1942.

The author records that a review of the literature indicates that more than a thousand species of plants have been reputed to have value as insecticides or have been tested or used as sources of insecticides, spreaders, adhesives, emulsifiers, repellents or attractants. But although many publications give the names of other plants that are poisonous to stock and other higher animals, or used as fish-poisons, few of these have been tested as insecticides. Botanical classification is no guide to insecticidal value.

CURTIS (W. E.). **A Method of locating Insect Eggs in Plant Tissues.**—*J. econ. Ent.* **35** no. 2 p. 286, 1 fig. Menasha, Wis., 1942.

The author describes a method of colouring the eggs of *Empoasca fabae*, Harr., when in the leaf-veins of the food-plant, with an indicator dye. It has been found useful for counting the eggs of this Jassid in the leaves of potato and broad bean (*Vicia faba*) and those of *Aceratagallia sanguinolenta*, Prov., in leaves of broad bean and petioles of clover ; eggs believed to be those of *Lygus oblineatus*, Say (*pratensis*, auct.) and of the greenhouse thrips [*Heliothrips haemorrhoidalis*, Bch.] were also seen in examining the leaves of broad bean.

SIEGLER (E. H.) & SMITH (L. E.). **Effect of Bentonite and of Hydrated Lime on the Toxicity of Phenothiazine to Codling Moth Larvae.**—*J. econ. Ent.* **35** no. 2 pp. 286–287, 1 ref. Menasha, Wis., 1942.

Phenothiazine [thiodiphenylamine] to which bentonite had been added gave poor results in tests against *Cydia* (*Carpocapsa*) *pomonella*, L. [*cf. R.A.E.*, A **24** 721], and in subsequent laboratory investigations it was found that chemical reaction took place between the two substances, which suggested that the use of bentonite as an adhesive for phenothiazine might reduce its effectiveness. As the addition of hydrated lime to the mixture appeared to retard the reaction, sprays containing 1 per cent. wetting agent and phenothiazine at a concentration of 4 lb. per 100 U.S. gals., alone or with 4 lb. bentonite, 2 lb. hydrated lime or both, were tested by the apple plug method [**21** 338] immediately after application and after the sprayed apples had been kept under room conditions for a week. The initial toxicity of phenothiazine alone, with hydrated lime and with bentonite and hydrated lime was high, giving 96, 91 and 93 per cent. mortality, respectively, but phenothiazine with bentonite alone gave only 80 per cent. There was a loss in toxicity after a week with all materials ; this was low in the case of phenothiazine alone, but more marked in the other cases.

ROARK (R. C.). **What is London Purple ?**—*J. econ. Ent.* **35** no. 2 pp. 287–288, 7 refs. Menasha, Wis., 1942.

Since a trade mark was issued in the United States in 1926 authorising the use of the name London Purple for an insecticide or fungicide, and the arsenical now sold under that name is different in composition from the one originally so called, experimenters recording the results of tests of London purple against insects should give the chemical composition of the product used. The compositions of samples of the proprietary product and of the earlier insecticide are given.

MOORE (Warren) & MOORE (M. B.). **Two Species of Black Carpet Beetle.**—*J. econ. Ent.* **35** no. 2 p. 288, 6 refs. Menasha, Wis., 1942.

Larvae of the genus *Attagenus*, collected in Virginia in 1936, included both chestnut brown and yellow individuals. In 1938, when offspring from them were separated according to colour, the resulting adults did not reproduce when crossed, though pairs from larvae of similar colour were extremely fertile. The species having yellow larvae is considered to be *Attagenus piceus*, Ol., descriptions of which correspond with it, but the other, which has black antennal clubs, has not been identified. The latter was the more numerous in collected material ; it also occurs in Illinois, where it appears to be the commoner species.

MARCOVITCH (S.). **Volatile Fluorine Compounds for the Control of Insects.**—*J. econ. Ent.* **35** no. 2 pp. 288–289, 2 refs. Menasha, Wis., 1942.

It has been found that volatile fluorine compounds, including hydrofluoric acid, silicon tetrafluoride, hydrofluosilicic acid and boron trifluoride, show high toxicity as fumigants against a wide variety of insects. Hydrofluoric acid gas can be generated by heating calcium fluoride and sulphuric acid, production of the gas being improved if an equal weight of calcium carbonate is added to the finely ground calcium fluoride, or the pure anhydrous acid can be used from containers or adsorbed on an inert material, such as carbon. In fumigation tests, adults of the cowpea Bruchid [*Bruchus maculatus*, F.] were readily killed in two hours by the hydrofluoric acid gas generated from about 2 oz. calcium fluoride per 1,000 cu. ft., and larvae within the cowpeas with that from 8 oz. per 1,000 cu. ft. Hydrofluoric acid is as toxic to insects as hydrocyanic acid at these rates, but it is much less toxic to man and other mammals and is less likely to be inhaled accidentally as it has a penetrating odour and an irritating effect.

GAMBRELL (F. L.), MENDALL (S. C.) & SMITH (E. H.). **A destructive European Insect new to the United States.**—*J. econ. Ent.* **35** no. 2 p. 289. Menasha, Wis., 1942.

Serious browning and dying of turf that occurred in certain localities in New York State in the spring of 1940 and the autumn of 1941 were found to be caused by the larvae of a Lamellicorn, later identified from larvae and adults collected in the infested areas as *Amphimallus majalis*, Razoum., var. *rufescens*, Latr. This appears to be the first record in North America of this species which is a native of southern and central Europe, where the larvae damage turf and the adults injure the foliage of coniferous and deciduous trees. Since severe injury by third-instar larvae occurred in two successive years, it appears that this species has a life-cycle lasting one year.

BILLINGS (S. C.), GOODHUE (L. D.) & SULLIVAN (W. N.). **A Pyrethrum-sesame Oil Aerosol used against Cheese Skipper Adults.**—*J. econ. Ent.* **35** no. 2 pp. 289–290, 1 ref. Menasha, Wis., 1942.

In view of the success obtained against mosquitos with aerosols produced by dissolving pyrethrins in dichlorodifluoromethane, with sesame oil as a synergist, and applying the solution as a spray [*R.A.E.*, B **30** 164], experiments were carried out, with *Piophila casei*, L., which is a common pest of cheese, smoked meat and smoked fish, to determine their effectiveness against other insects where the use of an insecticide non-toxic to man is desirable. The spray was applied in a room with a cubic content of 960 cu. ft., kept at a temperature of about 75°F., in which about 100 adults of various ages bred from smoked pork were released. A fan was operated for five minutes, and the room was kept shut for half an hour, after which the flies were counted and caged with a little sugar syrup. A dosage of 12·5 gm. solution containing 50 mg. pyrethrins and 116 mg. sesame oil and one of 6·25 gm. containing 25 and 58 mg. gave 98 and 66 per cent. mortality, at the end of 24 hours, and 1 gm. sesame oil in 130 gm. solvent gave small but very variable mortalities (13·0 and 23 per cent.), indicating a high degree of variability in resistance among the flies. There was little increase in mortality at the end of 48 hours. Pyrethrin solutions at the same concentrations, but without sesame oil, tended to give reduced mortality.

FLANDERS (S. E.). **The Introduction of *Physcus testaceus* Masi into California.**—*J. econ. Ent.* **35** no. 2 pp. 290–291, 2 refs. Menasha, Wis., 1942.

As observations made in Europe in 1939 showed that the Aphelinid, *Physcus testaceus*, Masi, attacked the fig scale, *Lepidosaphes ficus*, Sign., as well as *L. ulmi*, L., collections of this parasite, obtained from *L. ulmi*, were sent to California in 1939 and 1940. Males and females from these collections, together with males bred as hyperparasites on full-fed larvae of *Comperiella bifasciata*, How., an endoparasite of the yellow scale [*Aonidiella citrina*, Coq.], were liberated in March and June 1940 on a fig tree on the twigs of which *L. ficus* was abundant, but no recoveries have been made, possibly because the scale was either ovipositing or very immature at the time and therefore unsuitable for parasitism. *L. ficifoliae*, Berl., a leaf-infesting species, appears to be too small to serve as a host for this Encyrtid. The females are primary endoparasites and the males secondary ectoparasites. Studies with *L. ulmi* indicated that in some cases oviposition occurred in the half-grown scale and that the female emerged from the full-grown scale. The females of *L. ficus* hibernate, whereas *L. ulmi* overwinters in the egg stage. *L. ficus* is therefore more exposed to parasitism, and this may account for the fact that in Europe it is more adequately controlled. When developing in *L. ulmi*, the parasite overwinters as a full-fed larva or pupa and emerges before, or soon after, the host eggs begin to hatch, material collected in the field after January yielding few parasites, whereas in *L. ficus* it probably overwinters as an immature larva and emerges in summer.

If the development of the male in the field is dependent on the presence of full-fed female larvae, liberations should consist of large numbers of mated females, so that the first progeny to emerge in the field will have available larvae on which to oviposit. Establishment, therefore, may depend on the liberation of larger numbers than would be necessary otherwise. The life-cycle of the parasite is considerably shorter than those of the hosts, being about 28 days at 80°F. At temperatures between 65 and 75°F., the adult females may live 30–40 days.

Service and Regulatory Announcements, January-March 1942.—*S.R.A., B.E.P.Q.* no. 150 pp. 1–26. Washington, D.C., U.S. Dep. Agric., 1942.

Announcements relating to Quarantine no. 72 against *Pantomorus* spp. [*P. leucoloma*, Boh., and *P. peregrinus*, Buchanan] include Administrative Instructions (B.E.P.Q. 503 fourth revision) for the treatment of plants in pots or soil balls and of potting soil by methods already described [*R.A.E.*, A **30** 174, etc.] and authorise the fumigation of soil plots, plunging beds and potting soil that is not in a container with methyl bromide or carbon bisulphide applied as a liquid. The rate of application per square foot of soil surface and the minimum temperature of the soil at a depth of 6 ins. must be 4·7 ml. and 45°F. for methyl bromide and 33 ml. and 80°F. for carbon bisulphide, the former being injected into the soil at a depth of 6 ins. and the latter poured into holes at least 6 ins. deep and 1 in. in diameter at the top, which must immediately be covered with soil. After the application, the soil must be covered with 10–15 pound building paper, overlapping 4 ins. and weighted to prevent its being blown away, for at least 4 days after the treatment with carbon bisulphide and for 4 and 6 days after treatment with methyl bromide at soil temperatures above 62°F. and between 45 and 62°F., respectively, to ensure the mortality of all stages. The temperature of potting soil fumigated with methyl bromide in a container [**27** 591] must not be allowed to fall below 40°F. during the period of exposure.

Other information in this part includes summaries of plant-quarantine import restrictions in Burma and Ecuador and a supplement to restrictions already noticed in Cuba.

Wolcott (G. N.). **The Requirements of Parasites for more than Hosts.**—*Science* **96** no. 2492 pp. 317–318. Lancaster, Pa., 1942.

Attention is drawn to the fact that the survival of insect parasites is dependent on the presence not only of their hosts but also of factors favourable to the non-parasitic stages. The establishment in Porto Rico of the Sphegid, *Larra americana*, Sauss., the larva of which is parasitic on *Scapteriscus vicinus*, Scud., was apparently rendered possible by the presence there of *Borreria verticillata* and *Hyptis atrorubens*, which provide nectar for the adults [*cf. R.A.E.*, A **30** 423]. *Tiphia* spp., which parasitise white grubs [*Lachnosterna*], are scarce in Porto Rico, though their hosts are common, and this is probably due to the fact that wild parsley, the flowers of which are frequented by the wasps, is uncommon there. In Haiti, where this weed is widespread, *Tiphia* spp. are much more numerous. The Braconid, *Mirax insularis*, Mues., which parasitises 65–80 per cent. of the larvae of *Leucoptera coffeella*, Guér., on coffee in Guadeloupe, has become established in Porto Rico [*cf.* **30** 293], but the percentage parasitism of *L. coffeella* there rarely exceeds 1.

Weyrauch (W.). **La hormiga " coquis."** [Leaf-cutting Ants.]—*Bol. Mus. Hist. nat. " Javier Prado "* **6** no. 21 pp. 193–201, 5 figs. Lima, 1942.

Leaf-cutting ants cause considerable injury to fruit and shade trees in the mountain regions of Peru, and recent observations in the valley of Chanchamayo showed that the most harmful were *Atta cephalotes*, L., *A. sexdens*, L., and an undescribed species. A typical nest is described, and an account is given of its organisation. It is calculated that a large one may contain some three million individuals. The fungus gardens in the nests are sometimes destroyed by saprophytic bacteria, and the possibility of culturing these for artificial introduction is being investigated.

Wille (J. E.). **Resumen de las diferentes labores ejecutadas en el Perú para combatir insectos dañinos por el "método biológico."** [Summary of Work carried out on the biological Control of Insect Pests in Peru.]—*Bol. Mus. Hist. nat. "Javier Prado"* **6** no. 21 pp. 202–205. Lima, 1942.

A further review is given [*cf. R.A.E.*, A **25** 614] of work on the biological control of insect pests in Peru ; most of the additional information has already been noticed [**28** 242, 280 ; **29** 511]. Attempts to establish *Cryptolaemus montrouzieri*, Muls., against *Pseudococcus* spp., and the toad, *Bufo marinus*, against Lamellicorn larvae on sugar-cane [*cf.* **25** 614] have proved unsuccessful.

Baker (F. T.), Ketteringham (I. E.), Bray (S. P. V.) & White (J. H.). **Observations on the Biology of the Carrot Fly** (*Psila rosae* **Fab.**) **: Assembling and Oviposition.**—*Ann. appl. Biol.* **29** no. 2 pp. 115–125, 6 figs., 1 ref. London, 1942.

The habits of adults of the carrot fly, *Psila rosae*, F., were investigated in north Lincolnshire in 1941 in a 20-acre field in which carrots were growing and a 15-acre fallow field in which carrots had grown in 1940. The fields were surrounded with hedges of hawthorn (*Crataegus oxyacantha*) varying in height from 2 to 10 ft., and chervil (*Chaerophyllum sylvestre*) and hogweed (*Heracleum sphondylium*) were abundant in the hedge bottoms. The flies were collected by sweeping the hedges and on traps consisting of wooden blocks covered with an adhesive that were placed on the ground at scattered points over the carrot field. They were scarce on the lower hedges, but assembled in large numbers on the higher ones ; they were numerous on the chervil and hogweed only when these were sheltered by high hedges. They remained on the hedges until about 4 p.m. and most of them returned there at nightfall ; they did not move from shelter in dull, cool weather, and only flew short distances when the wind was strong, but during warm, still weather at least half left the hedges during the evening. Most congregated on the sheltered side of the hedge when the wind was blowing through it, even when the wind was low ; when a gale was blowing, they assembled on the lower surfaces of the leaves of hogweed and chervil on the sheltered side of the hedge. Where high hedges with abundant bottom growth occur near the site of emergence, dispersal is likely to be limited. The movement of the flies appears to be a general dispersal rather than a definite migration to carrots, since populations in the fallow field were large throughout the period of the investigation (11th June–1st July), decreases in the numbers present in one or more hedges coincided with increases in the numbers in hedges of the same or neighbouring fields situated down-wind, and populations in the carrot field were consistently lower than those in the fallow field. In addition, mature females were fairly abundant in the fallow field throughout the investigation, eggs were laid near potato and other plants, as well as carrot, and preliminary tests indicated that aromatic chemicals were not attractive to the adults.

Only one male was caught on the traps, whereas 170 females, of which 81 per cent. contained mature eggs, were taken, and the investigation is therefore thought to have coincided with the oviposition period. Oviposition was most concentrated near hedges with high populations. Damage in previous years had been greatest near hedges, especially where they were high or thick or where trees occurred, and in sheltered positions, and on 25th July 1941, damaged carrots were numerous only in a part of the field near hedges with high populations. Oviposition, the process of which is described, was in progress on 13th June and continued until 25th June, when there was a sudden decline ; it was favoured by warm, still weather, but did not appear to be influenced by humidity. Most eggs were laid between 4 and 8 p.m., in crevices ½–1 in. deep by the carrot drill-rows.

It is suggested that infestation of a crop by first-generation larvae could be reduced by spraying the hedges round fields in which carrots were grown in the previous year during the morning or late evening to destroy the adults of the over-wintered generation.

Symposium on Wireworm Investigations.—*Ann. appl. Biol.* **29** no. 2 pp. 144–196, 15 figs., many refs. London, 1942.

In the opening paper of this series on the wireworm problem in England and Wales, " Investigations on Wireworms : Introductory " (pp. 144–149), J. C. F. Fryer reviews work done since 1914 and particularly certain aspects and objects of the surveys of the wireworm populations of grassland that have been carried out since 1938, which are dealt with in more detail in the second and third papers.

In " Wireworms and Crop Production " (pp. 150–155), S. G. Jary describes work in 1938–41 on the estimation of larval populations by sampling [*R.A.E.*, A **30** 270, 284, etc.] and the susceptibility of various crops to damage by populations of different sizes. Surveys in grassland throughout the country established that populations exceeding a million per acre were common and that the highest exceeded three millions. Recommendations, based chiefly on the results of surveys in 1939–40, are given for the crops to grow in newly-ploughed grassland with populations of different sizes [**30** 455] and in fields in the second or subsequent years from the original ploughing (when the turf in the soil has decomposed). In the latter, only peas, beans and flax can be grown if the wireworm populations exceed 600,000 per acre and even these crops may be injured to some extent ; silage crops and possibly cabbage and allied crops can be grown safely where populations are below 600,000, but cereals, potatoes and sugar-beet can be safely grown only where populations are lower than 200,000.

Recent work has shown that populations do not always decrease in the second year after ploughing. Most of the larvae in the first and second instars are missed in sampling owing to their small size, and the estimates obtained probably represent only 15–20 per cent. of the total population, though they give a fair indication of the number of injurious larvae. If the young larvae survive, their presence compensates in the following year for the loss due to pupation and other causes. In grassland, mortality among the smaller larvae is high, owing to predators, diseases, etc., and although cultivation kills some of the larvae in arable land, it is thought to be more injurious to their natural enemies. The reliability and cost of sampling are discussed. The average cost is 4s. per acre and its use in south-eastern England, where about 50 per cent. of the fields support populations exceeding 600,000 per acre and would yield only poor crops of wheat, is therefore justified. Contrary to previous belief, derelict land, such as bracken-covered parkland, supports low populations, whereas many of the best pastures are heavily infested ; populations are, however, very high in derelict black-fen land. Although wireworm damage is the most widespread single factor causing crop destruction, satisfactory yields can be obtained in the presence of high populations if other conditions are favourable and cultivation is good.

In " Statistical Problems in Field Sampling for Wireworms," by F. Yates and D. J. Finney (pp. 156–167), the principles underlying field sampling are summarised with special reference to the use of soil samples in estimating wireworm populations. The results of sampling in England and Wales over a period of three years established that more precise estimates were obtained when the sampling unit was a cylindrical core 4 ins. in diameter and 6–9 ins. deep than when it was 6 ins. square and of the same depth, and that 20 such units per field give estimates of sufficient accuracy [**30** 270]. Populations in grassland were higher in the south-east and midland areas than in the north and west in both 1939–40 and 1940–41; they were lower in the second year than in the first, despite a reduction from 8 to 5 mm. in the lower size limit of the larvae collected. Populations in arable land in 1940–41 were lower than those in grassland, and the geographical trend was less noticeable.

In "Observations on some Factors influencing Growth in Wireworms of the Genus *Agriotes* Esch." (pp. 168–175), A. C. Evans & H. C. Gough describe a technique for rearing wireworms that permits detailed studies of individuals in relation to food, soil moisture, and other factors. It was found that a large portion of the larval period is spent in non-feeding phases during which the larvae increase in weight by absorption of water through the cuticle; and that the weight of a larva may remain constant or even decrease while it is consuming large quantities of food, owing to the replacement of water in the body by an equivalent amount of dry matter. The growth of larvae fed for various periods on different diets is shown on graphs. Opinions differ as to the extent to which wireworms can utilise decaying organic matter as food. In laboratory experiments, half-grown larvae confined in soil rich in organic matter lost dry weight to the same extent as those in soil containing little or none, but those in soil containing wheat grains increased in dry weight. In similar experiments with newly-hatched larvae, none survived in soil deficient in organic matter, or soil containing sewage sludge or farmyard manure; 6 per cent. survived when fed on decaying turf, 62 per cent. on carrot, and 73 per cent. on wheat. The mean weights after three months of newly-hatched larvae fed on wheat, carrot and decaying turf were 0·44, 0·37 and 0·25 mg., respectively. In experiments on the suitability of carrot, wheat and bean seeds as food for large larvae, the average increase in fresh weight in 34 weeks was 16·1 mg. in larvae fed on wheat, 8·7 mg. in those fed on carrot, and 2·5 mg. in those fed on bean seed. The larvae fed for an average of 14·3 weeks on wheat, and 9·4 weeks on carrot and bean seed, but in another experiment lasting 27 weeks, small larvae fed for half that time on both carrot and wheat, but increased in weight significantly more on wheat than on carrot. The occurrence of periods (spring and autumn) when damage is more severe than at other times may be due to the relationship of the fasting periods at ecdysis to the seasonal trend of temperature, and the continuance of feeding in one field after it has stopped in adjoining ones to the suitability of the food in the previous year. It is also suggested that the variable mortality noted in soil insecticide tests may be due to the varying physiological state of the larvae used and that the permeability of the cuticle in relation to the moulting cycle may be an important factor.

In "Wireworms and Agriculture, with special Reference to *Agriotes obscurus* L." (pp. 176–180), H. W. Miles briefly summarises the bionomics of this species and gives an account of work during 1937–41 on experimental plots at Warburton, Cheshire, on the influence of crop rotations on wireworm populations. On plots cropped in successive years with roots, potatoes and oats, there was a progressive decrease in numbers, followed by an increase during two years under grass. A sequence of green manure plants, potatoes and wheat also reduced populations, but they increased again after a year under grass; this increase continued when the grass was succeeded by oats, but populations fell when it was followed by potatoes. There was a marked increase in numbers in plots under grass for three years in succession. The most favourable conditions for infestation in the usual rotation (cereals, roots, cereals, clover) practised over most of England occur in the cereal-clover period, but since this is of short duration, high populations do not develop and injury is usually slight. The amount of injury caused by populations of given sizes may be influenced by local conditions: in north Cheshire, where the soil is deficient in humus and soil moisture, low populations often cause serious injury to potatoes.

In "Observations on the Biology of *Agriotes obscurus* L. I. The Adult Insect," by M. Cohen (pp. 181–196), an account is given of observations during 1937–40 in Lancashire and Cheshire, some of which have already been noticed

[**28** 235 ; **30** 283]. In 1940–41, 95 per cent. of the adults found in Cheshire and 76 per cent. of those found in Lancashire were *A. obscurus*. The beetles appear to remain in the soil in or near the pupal cell throughout the winter and spring. Emergence began during the last week in March [*cf.* **28** 156]. Most adults were trapped during periods when rain fell or when atmospheric humidity was high ; maximum catches coincided with maximum temperatures and preceded rainy periods. The essential factor influencing the habitat of the beetles is probably a high plant population, such as occurs in grassland, which affords close cover and, as a result of transpiration, high atmospheric humidity. They are negatively phototactic and active chiefly during the evening and night when the relative humidity, even among vegetation, is higher than during the day. The species appears to be distributed mainly by the flight of the adults, which in north-west England are most numerous during the latter half of May and the first half of June. Oöcytes were not visible in the ovaries of the females in October, but maturation was very rapid between the end of April and the middle of May. The beetles appeared to live only for one year, and were not active for more than five months ; mortality was highest among males during the first, and among females during the third, week in June. Oviposition was not observed in the field, but apparently occurs mainly in the top 6 ins. of soil, most eggs being deposited in the top 2–3 ins. Under laboratory conditions, oviposition took place over a period of 4–5 weeks in May and June ; in 1939, the peak period was between 22nd and 27th May. Hatching began in July and extended over 12 days in 1938 and 3 in 1939. The incubation period varied according to the time of year from 59 to 36 days. In general, the eggs were very resistant to soil fungi. The possibility is suggested of forecasting the degree of infestation by observations on the weather conditions, especially moisture, during the oviposition period and subsequently, since the development of the eggs and the survival of the larvae are both influenced by it ; soils with high water contents are thought to be most suitable for the larvae and for the development of large populations.

ROEBUCK (A.). **The Wireworm Problem on ploughed up Grassland in the Midland Province.**—[*Pamphl.*] *Midl. agric. Coll.* no. 1 pp. 16–24. Loughborough, 1942.

The author gives a brief account of the feeding habits of wireworms and the reasons for their prevalence in grassland, but points out that occasional instances of damage following oviposition on arable land occur on all types of soil in the Midland counties of England, and particularly on black-fen soils in Lincolnshire, and that attacks are likely in arable fields surrounded by large areas of grassland or interspersed with occasional grass fields, owing to the migration of the beetles. The density of the wireworm population in grassland in different districts of the Midland counties and possible reasons for the variations found are discussed, and suggestions are made for cropping ploughed grassland containing various known populations in the first and subsequent years [*cf.* *R.A.E.*, A **30** 455, etc.].

GUNN (D. L.) & WALSHE (B. M.). **The Biology and Behaviour of *Ptinus tectus* Boie. (Coleoptera, Ptinidae), a Pest of Stored Products. IV. Temperature Preference.**—*J. exp. Biol.* **19** no. 2 pp. 133–140, 2 figs., 15 refs. London, 1942.

The following is the authors' summary of this paper, which is one of a series [*cf.* *R.A.E.*, A **30** 161]. In a long temperature gradient apparatus, *Ptinus tectus*, Boield., aggregates around two distinct temperatures, 4 and 24°C. [39·2 and 75·2°F.]. In a circular temperature alternative chamber there is no marked avoidance of low temperatures if the gradient is steep, but characteristic avoiding reactions occur if the gradient is not very steep. When the stationary animals are subjected to rising or falling temperatures in the long gradient, there is a well-marked evacuation temperature at 30–33°C. [86–91·4°F.], but none at lower temperatures. A temperature preference around 24°C. is correlated with favourable temperatures for growth and other activities. The aggregation around 4°C. is the result of a failure of co-ordinated behaviour in a particular kind of gradient, and *P. tectus* is practically immobilised by cold in that temperature region.

KRATOCHVÍL (J.) & FARSKÝ (O.). **Das Absterben der diesjährigen terminalen Lärchentriebe.** [The Dying of the current Year's terminal Shoots of Larch.]—*Z. angew. Ent.* **29** pt. 2 pp. 177–218, 19 figs., 20 refs. Berlin, 1942.

An account is given of observations on the cause of a malformation of the shoots of larch that has been observed for some years in Bohemia and Moravia. It has been diversely attributed to Tetranychid mites [*R.A.E.*, A **15** 227], insects, fungi and viruses, but it is here shown to be due to a toxin injected in the process of feeding on the needles by a thrips, described from all stages as *Taeniothrips laricivorus*, sp. n., with a light colour form, *pallidicornis*, n. This thrips appears to be restricted to larch and is thought to occur throughout Central Europe. It was by far the most numerous of 23 species of Thysanoptera, a list of which is given, that were found in the crowns, the only others of any importance being two predacious species of *Aeolothrips*. The overwintered females appeared in May and oviposited in the young needles from mid-June onwards. Adults of the first and second generations were present in August and September–October, respectively. No overwintering males were found. The adults and nymphs fed on the needles at the tips of the shoots of the current year and migrated to other shoots when signs of injury appeared. The amount of damage increased with the thrips population and became most conspicuous in September. The injury is caused almost exclusively to the current year's shoots, chiefly in the summit of the crown, and especially to the leader. It affects the colour and shape of the needles, which later fall, distorts the shoots, causes an exudation of resin on which fungi develop, and, if severe, kills the terminal buds. The rapidity with which regeneration occurs depends on the vigour of the tree and the extent of the infestation. Lightly infested shoots sometimes produce fresh needles after feeding by the thrips has ceased in September.

T. laricivorus had many natural enemies, including entomogenous fungi, Hymenopterous parasites and the two species of *Aeolothrips*, *A. fasciatus*, L., and *A. vittatus*, Hal. Direct methods of control are impossible in forests, but efforts should be made to foster vigorous growth of the trees. Infestation has more serious results in mixed stands, because larches that are stunted by it are suppressed by the other trees.

MICHEL (E.). **Beiträge zur Kenntnis von** *Lachnus* (*Pterochlorus*) *roboris* **L., einer wichtigen Honigtauerzeugerin an der Eiche.** [Contributions to the Knowledge of *L. roboris*, an important Producer of Honey-dew on the Oak.]—*Z. angew. Ent.* **29** pt. 2 pp. 243–281, 13 figs., 53 refs. Berlin, 1942.

Honey-dew is one of the sources from which bees obtain honey [*cf. R.A.E.*, A **26** 460], and a considerable amount of honey-dew is produced on oaks in Germany by *Lachnus roboris*, L. An account is given of the biology and anatomy of this Aphid, and of the production and composition of the honey-dew. No injury is caused to the food-plant.

VON DEHN (M.). **Besteht die Möglichkeit, die Bienen am Besuch arsenbehandelter Pflanzen zu verhindern ?** [Is there a Possibility of preventing Bees from visiting Plants treated with Arsenic ?]—*Z. angew. Ent.* **29** pt. 2 pp. 282–308, 1 fig., 69 refs. Berlin, 1942.

The experiments described were carried out in an attempt to discover a substance that would repel honey-bees from plants sprayed or dusted with arsenicals. None of 27 gustatory repellents sprayed on to the plants proved effective, since the spray did not penetrate to the nectaries owing to their protected position, and the action of the best of 29 olfactory repellents lasted only for a few hours, so that it was of no practical value. Bees do not readily visit wet plants, and experiments with hygroscopic substances, notably magnesium chloride, which was applied as a spray at a concentration of 12 per cent., gave good results. This caused scorching of the foliage of grape-vines but did not injure potato. It is therefore suggested that in parts of Germany in which preventive arsenical sprays are applied once or twice during the season against the potato beetle [*Leptinotarsa decemlineata*, Say], magnesium chloride should be added to them. Though bees do not visit potato, they frequent flowering weeds in potato fields.

GÖTZ (B.). **Zum Geschlechtsverhältnis der Traubenwickler** *Clysia ambiguella* **und** *Polychrosis botrana*. [The Proportion of the Sexes in the Vine Moths, *Clysiana ambiguella* and *P. botrana*.]—*Z. angew. Ent.* **29** pt. 2 pp. 313–328, 9 figs., 19 refs. Berlin, 1942.

Investigations in two vineyard districts on the Rhine on the sex ratio in the vine moths, *Clysiana* (*Clysia*) *ambiguella*, Hb., and *Polychrosis botrana*, Schiff. [*R.A.E.*, A **27** 496] were continued on a larger scale in 1939–41. The results previously obtained by means of trap-glasses were confirmed. Adults of *C. ambiguella* were also caught by hand in 1941 in the same vineyards, and as in the bait-traps, there were more males at the beginning than at the end of the flight period, but no definite conclusion was possible, because the number and sex ratio of the moths taken varied considerably during the day.

In laboratory experiments with *P. botrana* in spring and *C. ambiguella* in summer, males emerged, on an average, a few days earlier than females. In summer, the pupal stage of *C. ambiguella* was as long for males as for females, but males pupated earlier.

THIEM (H.). **Im Obstbau schädliche Schildläuse.** [Coccids injurious in Orchards.]—*Kranke Pflanze* **19** nos. 3–6, pp. 24–28, 47–52, 4 figs., 3 refs. Dresden, 1942.

Notes are given on the bionomics and control of Coccids that are injurious to fruit trees and bushes in Germany, together with characters enabling fruit growers to recognise the various species concerned. Those dealt with are *Lecanium* (*Physokermes*) *coryli*, L., and *L.* (*Eulecanium*) *corni*, Bch., on plum ; *L.* (*Sphaerolecanium*) *prunastri*, Boy., on damson ; *L. bituberculatum*, Targ., which is occasionally found on apple ; and *Pulvinaria vitis*, L., *Phenacoccus aceris*, Sign., *Aspidiotus ostreaeformis*, Curt., *A. pyri*, Licht., *Lepidosaphes ulmi*, L., and *Epidiaspis leperii*, Sign. (*Diaspis betulae*, auct.), which occur on various fruit trees. Characters distinguishing the two indigenous species of *Aspidiotus* mentioned from *A. perniciosus*, Comst., which is established in Austria, are described in greater detail.

Insect Pests.—*Agric. Gaz. N.S.W.* **53** pt. 3 pp. 132–136, 8 figs., 1 ref. Sydney, 1942.

This part of a series on insect pests in New South Wales [*cf. R.A.E.*, A **30** 608] includes notes on the bionomics and control of *Agromyza phaseoli*, Coq., on beans [*cf.* **28** 564], and of *Perga dorsalis*, Leach, which infests *Eucalyptus* spp. and is common in the coastal areas. The eggs of this sawfly are deposited beneath the upper surface of the leaves, and the larvae, which are gregarious, cause serious defoliation on young trees. When fully fed, they leave the tree in a slow-moving mass and wander over the surface of the ground for several days before pupating. Pupation generally occurs in the softer soil against the trunk of a tree, the larvae burrowing to a depth of several inches and spinning their cocoons in rows against each other. Where the infestation is limited, hand picking is recommended, but where it is heavy a spray of 1½ lb. lead arsenate in 50 gals. water should be applied.

Termite (White Ant) Proof Construction for Brick Buildings in Adelaide, South Australia.—*Trade Circ. Div. For. Prod. Aust.* no. 44, 14 pp., 14 figs. Melbourne, 1939. [Recd. December 1942.]

The local building regulations in Adelaide require all residences to be made of brick, stone or concrete ; the floor foundations, floors, internal trim and roof supports are of timber, which should be protected against termites. Jarrah [*Eucalyptus marginata*], which is resistant to termites, is largely used for foundation timbers. Shields made of 26 gauge galvanised iron or copper [*cf. R.A.E.*, A **17** 730 ; **18** 114] are recommended for preventing termites from gaining access to buildings, and details of their application to brick structures are described and illustrated by figures.

HOROWITZ (B.). **Nicotine Products and their Importance as Insecticides.**—*Aust. J. Sci.* **4** no. 6 pp. 179–186, 41 refs. Sydney, 1942.

This survey, which is largely based on the literature, comprises brief sections on the chemistry of nicotine and its action and uses as an insecticide, and longer ones on the distribution and concentration of nicotine in tobacco plants and the factors that affect it before and after the leaves are harvested, the manufacture of nicotine products, and the economics and prospects of nicotine production in Australia by the cultivation of *Nicotiana rustica*, which appears, from experiments in several countries, to be the only species of tobacco plant suitable for the production of commercial nicotine.

Progress Reports from Experiment Stations Season 1940–41.—Med. 8vo, [2 +] 216 pp., ill. London, Emp. Cott. Gr. Corp., 1942. Price 3*s.* 0*d.*

The pests of cotton occurring at various Experiment Stations during 1940–41 are discussed as in previous years [*cf. R.A.E.*, A **30** 81, etc.]. W. G. Wells reports (pp. 15–17) that work in Queensland included an experiment in which sprays of 1 lb. lead arsenate, 1 gal. molasses and 6 gals. water were applied at different periods against *Heliothis armigera*, Hb. Increased yields were obtained only from treatments begun at the time of first flowering, and fortnightly applications were more effective than monthly ones. The increase in yield was greater at the first picking than at the second ; at the third and final pickings, the control plots yielded more than treated ones, but this was not sufficient to offset their reduced yield in the first two pickings. It indicated, however, that *Heliothis* injury in early and mid-season is to some extent followed by abnormally heavy bearing, and this confirms the known fact that early planting is a fairly effective method of escaping losses due to *Heliothis*. Observations suggest that arsenicals tend to reduce the fruiting capacity of the plant. Tentative conclusions on the value of trap crops of maize to protect cotton from *Heliothis* were that the method in which 6 per cent. of the acreage is sown to maize in three plantings at intervals of three weeks from the time that cotton is sown may prove ineffective when *Heliothis* populations are high, and that it might be improved by increasing the area of maize planted three weeks after cotton, since it tassels when *Heliothis* populations are normally at their peak. *Platyedra* (*Pectinophora*) *scutigera*, Hold., reduced the yield of cotton in central Queensland, most outbreaks being adjacent to areas of stand-over or rattoon crops. *Antarchaea chionosticta*, Turn., was widespread and destructive early in the year in the Callide Valley, chiefly in the vicinity of standover cotton, and Jassids were more injurious than usual.

A report on plant pathology at Barberton, South Africa, for the season 1939–40 by G. M. Wickens (pp. 43–64) includes an account of experiments on the course of crop production in relation to losses from attack by stainers, chiefly *Dysdercus nigrofasciatus*, Stål, and Pentatomids, mostly of the genus *Nezara*. Populations of fifth-instar and adult stainers remained small until, in plots not infested by bollworms, almost all the bolls contributing to final yield were more than four weeks old. Most of the F_1 generation appeared only shortly before this time, and could have had relatively little effect on the developing bolls. The effect of bollworm infestation was to destroy part of the normal crop and cause compensatory development of a later one, so that many bolls giving rise to final yield were exposed to large numbers of fifth-instar and adult stainers at a relatively early stage in their development and the later portions of the crop suffered considerably. The incidence of internal boll disease was slight, but it was higher in progressively later formed bolls.

Comparison of a number of varieties indicated that the distribution of the stainers and Pentatomids was random, except for a tendency to concentrate on varieties carrying relatively large numbers of green bolls, the effect of this being to equalise over all varieties the ratio of stainers to green bolls. Differences between varieties in incidence of direct feeding injury and internal boll disease appear to agree with the hypothesis that incidence is largely controlled by the measure of escape of the developing bolls from bug feeding, this measure of escape being greater the earlier the fruiting of the plant. Control of such damage therefore lies in the development of varieties capable of forming as large a crop over as short a period as possible and in reducing bollworm attack, which tends to prolong the period of crop production. Examinations of bolls indicated that the earlier bolls suffered most from attack by the organisms of external boll disease (chiefly bacterial rots); this does not accord with the principle that later formed crops are more liable to infection owing to an increase in local population of the pathogen, but climatic conditions became progressively less favourable to the inception of infections and to the extension of resulting lesions. A technique for breeding and infecting stainers for use in controlled inoculation experiments is described.

G. S. Cameron reports from Southern Rhodesia (pp. 84–85) that the season 1940–41 was not a good one for cotton. Damage from insects was not severe, although an increase occurred in the numbers of the Sudan bollworm [*Diparopsis castanea*, Hmps.], which was numerous towards the end of February and early in March, after which it persisted in small numbers for two months. The increase was traced to self-sown plants. The spiny bollworm [*Earias*], was also more numerous than usual, but damage by *Dysdercus* spp. was reduced. Considerable damage was caused to cotton by termites.

S. H. Evelyn reports from the Gezira Research Farm (pp. 97–98) that stored seed and specimen heads of sorghum throughout the Anglo-Egyptian Sudan are severely infested by *Sitotroga cerealella*, Ol., *Tribolium confusum*, Duv., and *T. castaneum*, F. (*ferrugineum*, Hbst.). Damage to stored seed at the Farm was so severe that it was often necessary to resow the greater part of the area of varietal trials and propagation plots, while many specimens kept in glass cases or cupboards were so severely attacked as to be useless for purposes of reference. Infestation of the seed was not prevented by dipping it in a 0·1 per cent. water solution of mercuric chloride and potassium iodide or heating it to harden the testa and reduce the moisture content, but naphthalene afforded complete protection to seed stored in tins or bags and seed heads in cupboards that were not moth-proof.

J. D. Jameson reports from Serere, Uganda (p. 124) that susceptibility to attack by *Lygus* was found to be strongly connected with the general succulence of the plant, the most succulent plants suffering the severest reaction.

Observations on cotton pests were made at a number of experiment stations in Tanganyika Territory. J. E. Peat reports (pp. 131–141) that attack by Jassids was of minor importance at Ukiriguru, but it was a serious factor in reducing cotton yields in the surrounding area. The Ukiriguru cotton crop was heavily attacked by Aphids in the latter part of January and in February, and severe stunting of the plants resulted. Attack was severe throughout the Lake Province, but the Aphids disappeared with the beginning of the March rains. Cotton-stainers were observed at Ukiriguru from April onwards, the most prevalent being *Dysdercus superstitiosus*, F., and *D. nigrofasciatus*, while *Calidea* was also present, but little loss was caused ; cotton staining was more serious inland early in the season than on the Lake shore. Considerable damage by the American bollworm [*Heliothis armigera*] in various parts of the Province appeared to be partly linked with the planting of very early maize. A. N. Prentice reports from the Lubaga Station, Shinyanga (pp. 147–149) that damage by insects was not so heavy as in the preceding year. *Dysdercus* spp. were troublesome from mid-season onwards, the early planted crop having set its crop before they could cause much harm. Late planted cotton and the second flush of flowers on early planted cotton failed to produce any crop, such bolls as survived the young stage being badly stained. Most of the district crops had lighter stainer attack than Lubaga, but occasional attack by *D. fasciatus*, Sign., was very heavy. *Calidea* suddenly appeared on early planted cotton in February and was plentiful on later planted cotton in April. *H. armigera* and *Earias* spp. were unimportant during the season. A. H. McKinstry reports from Kingolwira (pp. 154–155) that the most important damage to cotton was caused by stainers, which were present just before flowering in both the main stands of cotton. In land planted early in March, *D. cardinalis*, Gerst., was more numerous at first, but it was outnumbered by *D. fasciatus* during the green boll stage. *D. intermedius*, Dist., was present in small numbers and a few examples of *D. nigrofasciatus* were also taken. *Calidea* and *Nezara* were observed in small numbers in the observation plot planted in January. The damage by stainers was particularly severe in the crop planted in late March, and it is probable that stainer attack may cause serious damage to the seed of the plant breeding material in certain other seasons. The area carries a fair population of wild food-plants of *Dysdercus*. Damage by *Heliothis armigera* was slight except near early maize, which may serve as a breeding ground before the cotton-planting period in March.

H. C. Ducker & W. L. Miller report from the Domira Bay Station, Nyasaland (pp. 158–165) that termites were troublesome, their abundance apparently being associated with the cropping practice by which cotton immediately followed two years' rest under pigeon peas [*Cajanus cajan*]. Stand counts made systematically throughout the season showed that damage was ten times as great in cotton following pigeon peas as in cotton following ground-nuts. The main rotation is being adjusted to permit the planting of a hoed crop (maize) prior to the first break of cotton in the hope that the termites will be starved out in the dry season following the maize harvest.

Observations on *Diparopsis castanea* in the Lake Shore Area of Nyasaland, described by B. L. Mitchell (pp. 166–172), deal chiefly with an investigation of the factors that may affect the duration of the pupal stage. The pupae can be divided into three groups : short-term pupae, which begin to develop immediately after pupation, overwintering pupae, which lie dormant during the cold season and begin to develop between July and September with the advent of warmer weather, and diapausing pupae, which lie dormant over yet a further period, spanning the hot dry weather, and do not commence development until after the break of the rains. In nature, on the Lake Shore, these groups are distinct except for a slight merging of the short-term and over-wintering groups.

When larvae were fed from hatching to pupation exclusively upon food of known age, the classes ranging from very young buds to bolls 5–6 weeks old, moths from short-term and over-wintering pupae were obtained from all groups. Differences in the relative humidity to which pupae were exposed (50, 75 and 100 per cent.) had no apparent effect on the length of the pupal stage in short-term and over-wintering pupae or on the proportion of pupae remaining in diapause. A comparison of naked pupae and those in earthen cells indicated that the effect of removing the cocoon is to shorten the pupal stage by a few days in short-term pupae and by about two weeks in overwintering pupae. The most striking effect was to increase the proportion of over-wintering pupae and correspondingly reduce the proportion of diapausing pupae. The effect of blanketing with loose soil was intermediate between the other two treatments, suggesting that a temperature lag is the key to the problem. Changes visible in a living pupa that is developing are described ; they render it possible to determine when dormancy ceases. When kept in controlled humidities and weighed weekly, dormant pupae lost weight very slowly, with little difference between those in 50 and 100 per cent. relative humidity, but developing pupae lost weight with progressive rapidity, the rate of loss being governed by humidity, but not being proportional to it. In all treatments the moisture content of dormant pupae was maintained at about 60 per cent. throughout their dormant life. The moisture content of developing pupae tended to increase, rising to about 68 and 62 per cent. in 100 and 50 per cent. relative humidity, respectively. This strain in pupal developing in low humidities is considered to account for the appreciable mortality that occurs at emergence at a humidity of 50 per cent., many moths being unable to free themselves from the pupal shell or force an exit from the earthen cocoon. Submergence under water of dormant pupae, even for a period as long as four weeks during July, had little effect in inducing mortality, nor at this time of the year did it cause the termination of dormancy. There was some retardation effect in that the longer the pupa was submerged the longer it was before development actually started. When developing pupae were submerged, development was temporarily arrested. Mortality for three days submergence was nil, for five days 60 per cent. and for seven days 90 per cent. The delaying effects of submergence may account for the lack of moth emergences in nature during very wet periods. When larvae were allowed to pupate in sand and in loam, the sand produced only half as many overwintering pupae as the loam.

It was evident from the weekly examinations of living pupae that the individual is already destined to become either a short-term or a dormant pupa by the time the pupal stage is reached. Field evidence from the Lake Shore and the Lower River shows that diapausing pupae are formed during the dry months of the year [*cf.* **28** 528, 529]. Three factors that may play a part in stimulating the formation of dormant pupae are low minimum temperatures, nutrition and effective moisture content of the soil during prepupal life. The last factor may be important, since the prepupa has to form an earthen cocoon and uses up surplus water in its body in macerating the soil into a paste. It has been noticed that the size of cocoon is related to the moisture content of the soil, and it is believed that the pupa itself bears a similar relation. Further, it was observed that prepupae put down to pupate in soil of very low moisture content were unable to form a cocoon and died.

Work in the Lower River areas of Nyasaland is dealt with by E. O. Pearson (pp. 172–187). Analysis of the causes of crop loss showed that 58 per cent. of the bolls that developed contributed to the crop, 30 and 9 per cent., respectively, being destroyed by *Diparopsis* and *Dysdercus*, and the remainder by other factors. This shows a decrease in the percentage damage to the crop due to bollworm and stainer compared with the preceding year [*cf.* **30** 85]. Details are given of the course of activity of *Diparopsis* throughout the season. It seems probable that many of the larvae were killed by abnormally dry weather experienced in April and May 1941. The whole season was marked by very low stainer populations both on wild food-plants and in the crop. The annual or semi-perennial herbaceous food-plants, *Hibiscus vitifolius* and *H. physaloides* were extremely scarce. The stainer infestation in the crop followed much the same pattern as in 1940, but was of trifling extent. Initial immigrations of *Dysdercus intermedius* started in late April and extended into June, but breeding was restricted and no adult population derived from it was recorded in the crop. As food supplies for young nymphs were plentiful throughout May, the restriction in breeding must have been climatic. *D. fasciatus* appeared at about the same time and in even smaller numbers, but adults developed and remained in the crop and, under conditions of rising temperatures in August–September, succeeded in maturing populations amounting in some cases to 1,000 to 2,000 adults and fifth-instar nymphs per acre by late September. Small numbers of adults of *D. nigrofasciatus* were recorded during the season, but little breeding followed. These records confirm the suggestion [**30** 86] that stainer infestations are restricted during the cool dry season by the climatic factor, and substantiate the previously observed ability of *D. fasciatus* to survive under more extreme climatic conditions than *D. intermedius*.

D. A. Donald reports from Fiji (p. 216) that the chief pests of cotton in 1940–41 were *Earias fabia*, Stoll, which was a major pest, particularly attacking the Upland strains, the cotton Aphid [*Aphis gossypii*, Glov.], which was observed on Sea Island cotton as early as December and multiplied rapidly, but was later effectively controlled by spraying with tobacco extract, *Nezara viridula*, L., which occurred on cotton in small numbers early in the season and against which two colonies of *Microphanurus basalis*, Woll. [*cf.* **30** 157] were liberated, and *Empoasca* sp., which appeared late in the season and attacked all strains of cotton. Damage by cutworms, *P. gossypiella* and *Tectocoris diophthalmus*, Thnb. (*lineola*, F.) was slight.

Müller (K.). **Das Erscheinen der überwinterten Kartoffelkäfer im Frühjahr in seinen Beziehungen zur Bodentemperatur.** [The Appearance of overwintered Potato Beetles in Spring in Relation to Soil Temperature.]—*Z. PflKrankh.* **51** pp. 139–146. 1941. (Abstr. in *Zbl. Bakt.* (II. Ref.) **105** no. 10–11 p. 196. Jena, 1942.)

A knowledge of the date on which the overwintered adults of the potato beetle [*Leptinotarsa decemlineata*, Say] emerge from the soil is of importance in deciding when to begin the organised search for them in Germany. French workers have stated that they appear when the air temperature reaches 10°C. [50°F.] and become numerous when it is 14–15°C. [57·2–59°F.], but in experiments carried out between Mannheim and Heidelberg, the first adults did not appear until the temperature of the soil averaged 14·5°C. [58·1°F.] at a depth of 10 ins., so that the search for them need not be begun until later than has hitherto been the case.

Sachtleben (H.). **Ein neuer Parasit der Kleidermotte :** *Meteorus atrator* **(Curtis).** [A new Parasite of the Clothes Moth : *M. atrator*.]—*Arb. physiol. angew. Ent. Berl.* **8** pp. 206–208. 1941. (Abstr. in *Zbl. Bakt.* (II. Ref.) **105** no. 10–11 p. 206. Jena, 1942.)

A brief description is given of *Meteorus atrator*, Curt., which parasitises the clothes moth [*Tineola bisselliella*, Humm.]. This Braconid is not uncommon in central Europe [*cf. R.A.E.*, A **30** 546] and also occurs in Russia and Sweden.

LANGENBUCH (R.). **Zur Biologie des Erbsenwicklers** *Grapholitha nigricana* **Steph.** [On the Biology of the Pea Tortricid, *Cydia nigricana*.]—*Arb. physiol. angew. Ent. Berl.* **8** pp. 219–244. 1941. (Abstr. in *Zbl. Bakt.* (II. Ref.) **105** no. 10–11 p. 197. Jena, 1942.)

A detailed account is given of the bionomics of *Cydia* (*Grapholitha*) *nigricana*, Steph., which is the principal if not the only species of its genus that infests peas in Germany [*cf. R.A.E.*, A **22** 249]. *Ascogaster quadridentata*, Wesm., parasitised 25·8 per cent. of the larvae.

LANGE (E. G.). **Starkes Auftreten von Kartoffelkäfern an Bittersüsspflanzen.** [Occurrence of Potato Beetle on Bittersweet.]—*NachrBl. dtsch. PflSch-Dienst* **22** p. 2. 1942. (Abstr. in *Zbl. Bakt.* (II. Ref.) **105** no. 10–11 p. 197. Jena, 1942.)

Adults of the potato beetle [*Leptinotarsa decemlineata*, Say] are recorded as feeding extensively on the leaves and shoots of bittersweet [*Solanum dulcamara*] over considerable areas in Germany. Complete control was given by a spray of calcium arsenate.

GÖTZ (B.). **Laboratoriumsuntersuchungen über den Einfluss von konstanten und variierenden Temperaturen, relativer Luftfeuchtigkeit und Licht auf die Embryonalentwicklung von** *Polychrosis botrana*. [Laboratory Investigations on the Influence of constant and varying Temperatures, relative Air Humidity and Light on the embryonic Development of *P. botrana*.]—*Anz. Schädlingsk.* **17** nos. 7, 8, 11 pp. 73–83, 85–96, 125–129. 1941. (Abstr. in *Zbl. Bakt.* (II. Ref.) **105** no. 10–11 pp. 197–198. Jena, 1942.)

In the experiments described, the eggs of *Polychrosis botrana*, Schiff., developed within temperature limits of 10–35°C. [50–95°F.] and hatched at 10–38°C. [50–100·4°F.]. The duration of development depended mainly on temperature and was least (3·5 days) at 30°C. [86°F.]; it was little affected by relative humidity, but was prolonged at low temperatures if relative humidity was low. Mortality was increased by low humidity only at extreme temperatures. Temporary change from high to low temperature prolonged the egg stage, and change from low to high temperature shortened it. Change from medium to high or low temperature reduced mortality. Extreme temperatures (about 5° and 36·5°C. [41 and 97·7°F.]) were tolerated temporarily provided that the initial sensitive stage had been passed. Resistance was greater to low than to high temperatures. Light stimulated biting through the egg shell, so that most of the larvae hatched after daybreak, but did not accelerate development. Lack of light did not increase mortality.

SPEYER (W.). **Beobachtungen über das Zahlenverhältnis der Geschlechter bei der Kirschfruchtfliege** (*Rhagoletis cerasi* **L.**). [Observations on the Proportion of the Sexes in the Cherry Fruit-fly.]—*Z. PflKrankh.* **51** pp. 330–332. 1941. (Abstr. in *Zbl. Bakt.* (II. Ref.) **105** no. 10–11 pp. 198–199. Jena, 1942.)

The percentages of males among more than 6,000 adults of *Rhagoletis cerasi*, L., that emerged in 1934–37 from a batch of pupae [*cf. R.A.E.*, A **26** 346] were 48·2, 52·3, 58·9 and 70 in the four years, respectively; in all, 49·5 per cent. were males. In the first year of emergence, females were comparatively more abundant at the beginning of the emergence period than at the end, and this is in accordance with the finding that they require at least 8 days to mature their eggs [*cf.* **23** 225]. Egg maturation is largely independent of pairing.

GÖTZ (B.). **Vergleichende Mottenflugbeobachtungen zum Massenwechsel der Traubenwickler.** [Comparative Observations on Adult Flight in Connection with Variation in Abundance in Vine Moths.]—*NachrBl. dtsch. PflSch-Dienst* **22** pp. 15–17. 1942. (Abstr. in *Zbl. Bakt.* (II. Ref.) **105** no. 10–11 p. 198. Jena, 1942.)

Counts of vine moths taken in traps in 1938 and 1939 at Rüdesheim, in the Rhineland, showed that *Polychrosis botrana*, Schiff., was several times as numerous as *Clysiana* (*Clysia*) *ambiguella*, Hb., whereas up to 1900 the latter was the more numerous. In 1940 and 1941 the increase of *P. botrana* was interrupted. The population of *C. ambiguella* also decreased somewhat in 1940, but there was a mass increase in 1941. At Geisenheim, *C. ambiguella* was the commoner species in all years and the population of *P. botrana* fell to a very low level in 1940–41. The variations in abundance of the two moths are thus independent of each other and are influenced by the weather. The years 1940 and 1941 were comparatively wet, a condition that is more favourable to *C. ambiguella* than to *P. botrana*.

MÜLLER (H. J.). **Beiträge zur Biologie des Rapsglanzkäfers** *Meligethes aeneus* **F.** [Contribution to the Biology of the Rape Beetle *M. aeneus*.]—*Z. PflKrankh.* **51** pp. 385–435. 1941. (Abstr. in *Zbl. Bakt.* (II. Ref.) **105** no. 10–11 p. 199. Jena, 1942.)

When the overwintered adults of *Meligethes aeneus*, F., emerge from their hibernation quarters, the gonads of the males are fully developed, but those of the females are not. They feed for some time on the nectar of spring flowers, and when the eggs are mature, the females migrate to the rape fields and oviposit. The young adults that appear from mid-June onwards feed first near the place where they emerged, but also on wild mustard, etc. In the second half of July they move to meadows, where they continue feeding, and about the end of July they suddenly seek winter quarters.

MEYER (E.). **Ueber das Schadauftreten von** *Sitona puncticollis* **Steph.** [On the injurious Occurrence of *S. puncticollis*.]—*Z. PflKrankh.* **51** pp. 324–329. 1941. (Abstr. in *Zbl. Bakt.* (II. Ref.) **105** no. 10–11 pp. 199–200. Jena, 1942.)

In January 1939, red clover near Cologne was heavily infested by *Sitona puncticollis*, Steph., which had not previously been recorded as a pest in Germany. On an average there were 100 weevils on each clover plant. Lead-arsenate sprays gave no control, but dusts of calcium arsenate were effective. The weevils fly little, and reinfestation was prevented by means of trap-ditches 8 ins. deep.

MAERCKS (H.). **Das Schadauftreten der Wiesenschnaken (Tipuliden) in Abhängigkeit von Klima, Witterung und Boden.** [Injurious Occurrence of Tipulids in Dependence on Climate, Weather and Soil.]—*Arb. physiol. angew. Ent. Berl.* **8** pp. 261–275. 1941. (Abstr. in *Zbl. Bakt.* (II. Ref.) **105** no. 10–11 p. 200. Jena, 1942.)

Tipulids are favoured by mild winters, cool summers, an average annual rainfall of at least 24 ins. and wet soil, especially moorland soil, so that in north-western Germany, where these conditions obtain, they are particularly injurious. *Tipula paludosa*, Mg., is the principal species, but in marshland it is replaced by *Nephrotoma* (*Pales*) *maculata*, Mg. [*cf. R.A.E.*, A **29** 68]. Considerable damage may be expected after abnormal rainfall in September, especially if the winter is mild. Heavy rain in August also favours an increase if temperatures then and in September are low. The best preventive measure against Tipulid larvae in grassland is good drainage.

PAPE (H.). **Tausendfuss-Schäden an Steckrüben.** [Millepede Damage to Swedes.]—*Z. PflKrankh.* **51** pp. 135–139. 1941. (Abstr. in *Zbl. Bakt.* (II. Ref.) **105** no. 10–11 p. 200. Jena, 1942.)

Swedes cultivated experimentally in Holstein in 1934 were attacked by the millepedes, *Cylindroiulus oweni*, Bollman (*frisius*, Verh.) and *Blaniulus guttulatus*, Bosc, the former predominating. It was confirmed that millepedes usually attack only injured plants. In this case, drought and heat had greatly checked plant growth.

MÜHLE (E.). **Die Blattwespe** *Selandria serva* **F. als Schädling wichtiger Futtergräser.** [The Sawfly *S. serva* as a Pest of important Fodder Grasses.]—*NachrBl. dtsch. PflSchDienst* **21** pp. 85–86. 1941. (Abstr. in *Zbl. Bakt.* (II. Ref.) **105** no. 10–11 pp. 200–201. Jena, 1942.)

Larvae of *Selandria serva*, F., were observed in 1939 feeding on *Lolium perenne* and *L. italicum* in Germany; this sawfly had not previously been recorded from these grasses. There are three generations a year, and the larvae hibernate in earthen cells. Mature females are present from mid-May onwards and deposit their eggs along the mid-ribs of the grasses. The larvae begin feeding from the edge of the leaf. *Poa pratensis*, *Alopecurus pratensis* and *Phalaris arundinacea* were also attacked. Parasitism was high at the end of 1941, and the larvae were very susceptible to contact poisons.

[GULYAKOV (D.).] GULJAKOW (D.). **The Use of Ammonia in the Control of Grain Warehouse Pests.** [*In Russian.*]—*Müllerei u. Elevatorwirtsch.* 1940 no. 12 pp. 22–24. 1940. (Abstr. in *Zbl. Bakt.* (II. Ref.) **105** no. 10–11 pp. 201–202. Jena, 1942.)

Ammonia gas is toxic to the grain weevil [*Calandra granaria*, L.] and mites and more so to the eggs of the latter than chloropicrin. The germinating power of dry grain, with a moisture content of 12·2 per cent., was not affected by exposure to a dosage of 8–12 oz. per 100 cu. ft. for 24 hours, but was destroyed by 16–20 oz.; exposure to the latter for up to 2 hours was not harmful. If the grain was aired after fumigation by spreading it in a thin layer, a slow recovery of germinating power occurred. Grain with a moisture content of 14·6–15·2 per cent. lost its germinating power after exposure to 12–20 oz. per 100 cu. ft. for more than ¼–2 hours, and did not recover it after airing.

KÖRTING (A.). **Untersuchungen über den Einfluss der Nahrung auf die Entwicklung des Kornkäfers** (*Calandra granaria* **L.**). [Investigations on the Influence of various Foods on the Development of *C. granaria*.]—*Arb. physiol. angew. Ent. Berl.* **8** pp. 275–289. 1941. (Abstr. in *Zbl. Bakt.* (II. Ref.) **105** no. 10–11 pp. 202–203. Jena, 1942.)

The duration of development of *Calandra granaria*, L., is 1–3 days shorter in wheat than in rye or barley. The weight of the weevils varies with the food, and is lowest in oats, increasing progressively in wheat, barley from which the glumes have been removed and maize. In wheat and barley, the percentage of males is greater than in rye. About twice as many eggs are laid in wheat and rye as in barley; this is due to the mechanical protection afforded to barley by the glumes. Females often tend to oviposit in grain of the same kind as that in which they developed.

TOKAREWA (R. R.). **A new Method for determining whether Grain has been attacked by Pentatomids.** [*In Russian.*]—*Müllerei u. Elevatorwirtsch.* 1940 no. 10 pp. 9–10. 1940. (Abstr. in *Zbl. Bakt.* (II. Ref.) **105** no. 10–11 p. 203. Jena, 1942.)

The following method enables injury to grain by Pentatomids [*Eurygaster*, etc.] to be detected. A sample of 5 gm. of the grain is ground up, mixed with

15 cc. distilled water at 40°C. [104°F.] and kept for 15 minutes at 37–40°C. [98·6–104°F.]; 2 cc. of the liquid is then filtered into a test tube and 10 drops of Millon's reagent (a solution of mercury in nitric acid with a specific weight of 1·42) added. The test tube is held for 2–3 minutes in boiling water and shaken up. The liquid turns reddish if the grain has been injured by the bugs.

KRETOWITSCH (W. L.) & TOKAREWA (R. R.). **Character and Identification of Injury to Grain by Pentatomids.** [*In Russian.*]—*Müllerei u. Elevatorwirtsch.* 1940 no. 7–8 pp. 29–30. 1940. (Abstr. in *Zbl. Bakt.* (II. Ref.) **105** no. 10–11 p. 203. Jena, 1942.)

The only correct method for determining the extent of injury to grain by Pentatomids [*Eurygaster*, etc.] is evaluation of the dough and gluten. In injured grain the content in total nitrogen is somewhat reduced, but the content of water-soluble nitrogen is much increased and that of gliadin-nitrogen is also somewhat higher. The pH remains almost unaltered, but the activity of the diastase is increased.

SPEYER (W.). **Dinitrokresol-Lösungen zur Vernichtung der Kirschfliegentönnchen.** [Solutions of dinitro-ortho-cresol for destroying the Pupae of the Cherry Fly.]—*NachrBl. dtsch. PflSchDienst* **21** pp. 80–81. 1941. (Abstr. in *Zbl. Bakt.* (II. Ref.) **105** no. 10–11 p. 204. Jena, 1942.)

In the experiments described, solutions of materials containing dinitro-ortho-cresol gave no control of pupae of the cherry fly [*Rhagoletis cerasi*, L.] and were poisonous to plants.

KÖRTING (A.). **Zur Bekämpfung der Möhrenfliege** (*Psila rosae*). [On the Control of *P. rosae*.]—*Mitt. biol. Reichsanst.* no. 64 pp. 43–50. 1941. (Abstr. in *Zbl. Bakt.* (II. Ref.) **105** no. 10–11 pp. 204–205. Jena, 1942.)

In view of the long oviposition period of the carrot fly, *Psila rosae*, F., control can be obtained only with insecticides that remain effective for a considerable time or by making several applications. An emulsion of petroleum oil and soap is effective, but affects the flavour of the carrots. Corrosive sublimate (mercuric chloride) cannot be used owing to its poisonous effect on man. Infestation was reduced, however, to about 4 per cent. by frequent applications of naphthalene to the fields. Serious losses can be avoided to some extent by early or very late sowing, but no protection was afforded by sowing onions between the carrots.

JANCKE (O.). **Stand der chemischen und biologischen Bekämpfung der Blutlaus.** [Present Position of chemical and biological Control of Woolly Aphis.]—*Kranke Pflanze* **18** pp. 26–29. 1941. (Abstr. in *Zbl. Bakt.* (II. Ref.) **105** no. 10–11 p. 205. Jena, 1942.)

Aphelinus mali, Hald., does not afford much control of the woolly apple aphis [*Eriosoma lanigerum*, Hsm.] in Germany. The parasite increases in early summer with an increase in the population of the Aphid, but is checked in July and August by the reduction that occurs then in Aphid reproduction. Furthermore, the rate of increase of the Aphid is greater than that of the parasite. Chemical control is therefore indispensable, and winter spraying with a tar distillate is the chief measure.

BRIEJÈR (C. J.). **Bestrijding van de Narcisvlieg** (*Merodon equestris* **F.**) **door middel van methallylchloride (M-gas).** [Control of the Narcissus Fly (*M. equestris*) by Means of Methallyl Chloride.]—*Tijdschr. PlZiekt.* **47** pp. 145–148. 1941. (Abstr. in *Zbl. Bakt.* (II. Ref.) **105** no. 10–11 p. 205. Jena, 1942.)

Fumigation with methallyl chloride [*cf. R.A.E.*, A **28** 76] at the rate of 0·8 oz. per 10 cu. ft. for 6–8 hours at about 20°C. [68°F.] has given good results against larvae of *Merodon equestris*, F., in narcissus bulbs in Holland. When this concentration was tested in cool weather in a closed gas-proof building, it gave 86·5 per cent. mortality of the larvae after an exposure of 24 hours.

MÜLLER-KÖGLER (E.). **Beobachtungen über das Verpilzen von Forleulenraupen durch** *Empusa aulicae* **Reich.** [Observations on the Infestation of Larvae of *Panolis flammea* by *Empusa aulicae.*]—*Z. PflKrankh.* **51** pp. 124–134. 1941. (Abstr. in *Zbl. Bakt.* (II. Ref.) **105** no. 10–11 p. 206. Jena, 1942.)

In the course of work against *Panolis flammea*, Schiff., on pines in the forestry district of Tornau, Saxony, in 1938, extensive destruction of the larvae by the fungus, *Empusa aulicae*, was observed. On 27th July, some mummified larvae were seen ; on the following day 50 per cent. of the larvae were dead, and a count on the third day showed 93·5 per cent. infected and dead. The dead larvae were in the fourth and fifth instars, and their colour varied from black to brownish-green.

SCHWITZGEBEL (R. B.) & WILBUR (D. A.). **Coleoptera associated with Ironweed,** *Vernonia interior* **Small in Kansas.**—*J. Kans. ent. Soc.* **15** no. 2 pp. 37–44, 5 figs., 9 refs. Manhattan, Kans., 1942.

The following is based on the authors' summary of this account of Coleoptera found during a survey of the insects associated with *Vernonia interior* in Kansas, where it is an important pasture weed, and a study of their biology carried out between June 1939 and July 1940. At least 47 species of Coleoptera belonging to 14 families were taken on the plant, and at least 13 species fed on some part of it. Approximately 40 per cent. of the stems examined were infested by one or other of the Lamiids, *Ataxia hubbardi*, Fisher, *Hemierana marginata* ab. *ardens*, Lec., and *Hippopsis lemniscata*, F., and the Mordellid, *Mordellistena pustulata*, Melsh., was found in 96 per cent. of the stems. The leaves were attacked by the Meloids, *Macrobasis immaculata*, Say, and *Epicauta cinerea*, Forst., the stems and terminal growth by the weevils, *Rhodobaenus tredecimpunctatus*, Ill., *Pantomorus pallidus*, Horn, *Aulobaris scolopax*, Say, and *Anametis setosus*, Blatch., and the roots by the Melolonthids, *Lachnosterna* (*Phyllophaga*) *lanceolota*, Say, and *L.* (*P.*) *crassissima*, Blanch.; and an Elaterid of the genus *Melanotus*.

THATCHER (T. O.). **A new Genus of Scolytidae (Coleoptera) from Utah and Nevada.**—*Proc. Utah Acad. Sci.* **17** pp. 89–91, 1 pl. Salt Lake City, 1940. [Recd. December 1942.]

Descriptions are given of the adults of both sexes of *Xylocomesus cercocarpus*, gen. et sp. n. (the type) from *Cercocarpus ledifolius* at an elevation of 8,000 ft. in Nevada, and *X. knowltoni*, sp. n., from *Populus tremuloides aurea* in Utah. Adults of the former enter both living and decaying trees through old wounds and work in the heartwood next to the sapwood. An associated fungus is probably carried by them. Keys to the species and to *Xylocomesus* and related genera of SCOLYTINI are included.

MILLER (R. L.). **Insecticidal Problems of entomological Service.**—*Florida Ent.* **25** no. 1 pp. 1–5. Gainesville, Fla., 1942.

A brief account is given of a few of the commoner problems involved in the use of insecticides, with particular reference to their application to *Citrus*, and of methods of attempting to solve them. The most important is the selection of the best material for the control of each pest in the particular circumstances in which it occurs, involving a consideration of the physiological effect of each insecticide on the pest and on the plant. Some problems in the actual manufacture of the insecticides are discussed, including mechanical difficulties, the incompatibility of certain insecticides, conditioning and wetting agents, adhesives and nutritional mixtures, and the complicated chemical nature of oil sprays and particularly of many of the organic compounds now used as emulsifiers. The author points out that the most frequent cause of failure in the application of insecticides is lack of understanding of the materials or of the action of the particular material on the insects involved, and recommends that the manufacturer should supply as much information as possible on factors that may affect the successful use of a given preparation, such as the amount and concentration required, the most satisfactory method of application, time of day, wind, condition of the foliage and stage of maturity of the crop, as the margin between the toxicity of insecticides to insects and to plants is often very small.

DA COSTA LIMA (A.). **Insetos do Brasil. 3° Tomo. Homópteros.** [Insects of Brazil. Vol. 3. Homoptera.]—327 pp., 267 figs., many refs. Rio de Janeiro, Escola nac. Agron., 1942.

This volume on Homoptera is arranged according to superfamilies, for each of which an account of the morphology and biology is given, with notes on species of economic importance in Brazil. Each section has its bibliography, in addition to a general bibliography at the end of the volume.

CHERIAN (M. C.) & ANANTANARAYANAN (K. P.). **A Pyralid Caterpillar Pest—*Nephopteryx eugraphella* Rag.—on Sapota.**—*Curr. Sci.* **11** no. 1 p. 23. Bangalore, 1942.

Damage to sapota [*Achras sapota*] by *Nephopteryx eugraphella*, Rag., was first observed in Coimbatore in 1938 and was more severe in 1941. This Pyralid has been recorded elsewhere in India on sapota and also on *Mimusops elengi*. The eggs are laid on the leaves and buds of young shoots. The larvae hatch in 3–5 days and bore into the buds, or feed on the surface of the leaves. After 17–35 days, they pupate in folds of leaves, the moths emerging 7–12 days later. Infested trees can be recognised by the numerous webbed shoots, dry leaf clusters and dark brown patches on the leaves.

PAPERS NOTICED BY TITLE ONLY.

SCHAERFFENBERG (B.). **Bestimmungsschlüssel der wichtigsten deutschen Scarabaeidenlarven.** [A Key to the most important German Lamellicorn Larvae.]—*Z. PflKrankh.* **51** pp. 24–42. 1941. (Abstr. in *Zbl. Bakt.* (II. Ref.) **105** no. 10–11 p. 199. Jena, 1942.)

BALDUF (W. V.). **The Oviposition Habits of *Feltia subgothica* Haworth.**—*J. econ. Ent.* **35** no. 2 p. 290. Menasha, Wis., 1942. [*Cf. R.A.E.*, A **19** 453.]

THOMSSEN (E. G.) & DONER (M. H.). **Attractants and Repellents for Insects.** [A review of the literature.]—*Soap* **18** no. 4 pp. 97–99, 105, 107, no. 5 pp. 95–96, 105, 35 refs. New York, N.Y., 1942.

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